

POPULAR **Computing** WEEKLY

24 June 1982 Vol 1 No 10

30p

**Shark attack
on ZX81**

**Reviews:
ZX81 assembler**

**ICL education
tapes**

Vic A-maz-ing

Telesound 82

Spectrum graphics





KAYDE Electronic Systems ZX80/1 ZX KEYBOARD WITH REPEAT KEY

£37.95
inc VAT

Fully cased keyboard £37.95
Uncased keyboard £27.95
Keyboard Case £10.95

This is a highly professional keyboard using executive buttons as found on top quality computers. It has a repeat key and comes complete in its own luxury case. This is a genuine professional keyboard and should not be confused with toy keyboards currently available on the market.



KAYDE 16K RAM PACKS

The 16K RAMPACK simply plugs straight into the user port at the rear of your computer. It is fully compatible with all accessories and needs no extra power and therefore it will run quite happily on your Sinclair power supply. It does not over-heat and will not lose memory at all. As you may know, some makes go down to 11K after being on for a while.

£29.95
inc VAT

This 16K RAMPACK is very stable and will not wobble or cause you to lose your programme. It comes fully built and tested with a complete money-back Guarantee.

KAYDE FLEXIBLE RIBBON CONNECTOR

*Stops movement of RAM PACK and other accessories
(Not needed with a KAYDE RAMPACK)*

£12.95
inc VAT

KAYDE 4K GRAPHICS BOARD

The KAYDE Graphics Board is probably our best accessory yet. It fits neatly inside your ZX81. It comes complete with a pre-programmed 2K Graphics ROM. This will give nearly 450 extra graphics and with the inverse makes a total of over nine hundred.

£29.95
inc VAT

The KAYDE Graphics Board has facilities for either 2K of RAM (for user definable graphics), 4K of ROM or our 4K Tool Kit Chips that will be available shortly. All the graphics are completely software controlled, therefore they can be written into your programmes. Here are a few examples: A full set of space invaders — Puckman — Bullets, Bombs — Tanks — Laser Bases and Alien Ships.

NO EXTRA POWER NEEDED

KAYDE 16K GRAPHICS BOARD SOFTWARE

PECKMAN: The only true ZX version of the popular arcade game.
Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garratt, Interface.

SPACE INVADERS: The best version available anywhere. Graphics software can only be used with a graphics board.

£5.95
each

KAYDE 16K 81 SOFTWARE

Centipede: "In all I think this is the best presented moving graphics program I've yet seen." Phil Garratt, Interface.

3D/3D Labyrinth: A Cubit Maze that has corridors which may go left, right, up, down. Peckman (the latest addition in 81 games).

£5.95
each

**WHY WAIT TO PAY MORE —
FAST, IMMEDIATE DELIVERY**

Post to: Dept PW2
Kayde Electronic Systems Ltd
The Conge
Great Yarmouth
Norfolk NR30 1PJ
Tel: 0493 57867 (Dept. PW1)



BARCLAYCARD

VISA

100% CASH

Please send me ZX Keyboards with repeat key £37.95 each
Please send me 16K RAMPACKS £29.95 each
Please send me Flexible ribbon connectors £12.95 each
Please send me 4K graphics boards £29.95 each
Please send me 16K graphics board software £5.95 each
Please send me 16K 81 software £5.95 each

I enclose

Name

Address

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

*Don't forget you can always order on
the telephone with your credit card*

All products include VAT are fully
built and tested and come with a
COMPLETE MONEY BACK GUARANTEE

Please add £1.50 p&p for all hardware and 50p for all software. Please make
cheques payable to Kayde Electronic Systems Ltd.

POPULAR Computing WEEKLY

The Team

Editor

Brendon Gore

Reporter

David Kelly [01-930 3271]

Sub-editor

Peter Harvey

Editorial Secretary

Fiona McCormick

Advertisement Manager

David Lake [01-839 2846]

Advertisement Executive

Alastair Macintosh [01-930 3840]

Managing Editor

Duncan Scott

Publishing Director

Nick Hampshire

Popular Computing Weekly,
Hobhouse Court, 19 Whitcomb Street,
London WC2
Telephone: 01-839 6835

Published by Sunshine Publications Ltd.

Typesetting, origination and printing by
Chesham Press, Chesham, Bucks

Distributed by S M Distribution
London SW9. 01-274 8611. Telex: 261643

© Sunshine Publications Ltd 1982

Subscriptions

You can have Popular Computing Weekly sent
to your home: the subscription rate is £19.95 per
year, for addresses in the UK.

How to submit articles

Articles which are submitted for publication
should not be more than 1000 words long.

All submissions should be typed and a double
space should be left between each line.

Programs should, whenever possible, be
computer printed.

At present we cannot guarantee to return
every submitted article, so please keep a copy.

Accuracy

Popular Computing Weekly cannot accept any
responsibility for any errors in programs we
publish, although we will always try our best to
make sure programs work.

This Week



Cover Illustration by Ian Craig

| | |
|--|-----------|
| News | 5 |
| Assurance on BBC delivery. | |
| Club Reports | 7 |
| Lessons learnt at Manchester. | |
| Shark Attack | 8 |
| Dave McGuire explains how to kill marauding sharks. | |
| Reviews | 10 |
| Telesound 82, A-maz-ing Vic-pack and ICL's "Fun to Learn" series for the ZX81. | |
| Open Forum | 12 |
| Seven pages of programs for the Vic-20, BBC Micro and ZX81. | |
| Programming | 21 |
| Memory saving techniques by Stephen Devine. | |
| Spectrum | 22 |
| Nick Hampshire examines more of the Spectrum's graphics facilities. | |
| Hand & mouth | 23 |
| Macro Assemblers and Reverse Polish Notation. | |
| Sound & vision | 24 |
| Three graphics tricks for the ZX81 by Nick Godwin. | |
| Peek & poke | 25 |
| Your questions answered. | |
| Competitions | 26 |
| Puzzle, crossword. | |

Editorial

With the advent of the Sinclair ZX Spectrum and the new range of Commodore Vics, there is a growing market for second-hand microcomputers.

Budding programmers, who learnt their skills on the ZX80/81, are now looking for more advanced machines. Consequently, they are also looking to trade-in their old machines.

The era of the used micro is now upon us.

No one is quite sure, yet, what effects the second-hand market will have on microcomputer users and manufacturers. But some trends are already becoming apparent.

It is now possible for a first-time user to buy a second-hand 1K Sinclair ZX81 for around £50. This puts microcomputers within range of more people than ever before.

Present ZX81 owners will also find it easier to buy more expensive machines, using the money gained from selling their existing ZX81s.

There are pitfalls in buying second-hand micros, just as there are in buying second-hand cars. But, if you take reasonable care to ensure that the micro is in good working order, you could get yourself a bargain.

Next Week



It's an android world and you must master the art of robot control — another game to test your wits

Classified

"ASTEROIDS" for unexpended VIC-20. Arcade type game on cassette, £3. Tel: 0579 470062.

SELLING ZX81 SOFTWARE. Quality famous material. (Getting Spectrum.) Knockdown prices. Tel: 01-455 2993 9-10 pm (not Saturday).

ZX81 16K. Large keyboard, cassettes and books. Make me an offer. T. McQueen, 35 Berhaim Gardens, Brixton Hill, London SW2.

ZX81 16K. 980-worth software on 13 tapes including Galaxians, £100. Tel: Swindon 770461.

ZX81, NEW 16K RAM. Fourteen games programs, including 3D Defender, 3D Monster, Maze and Invaders, £100. Tel: Watford 37919.

ZX81 plus separate keyboard/computer keyboards type) plus manual and three books, £20. Tel: 041-942 4476, 6 pm.

ZX81 16K, one month old plus two tapes, £20. Tel: Camforth 735787.

ZX81 16K, under guarantee. Six program cassettes (Invaders and Mazogs), £30. Tel: Totter 861181.

ZX81, perfect, with manual and games, £45. Tel: 254 5645.

3.5K VIC SOFTWARE, Ski-run, 50-frog, slalom, optional joystick control.

£5.95. T. Haywood, Sea Glimps, Dottery, Bridport, Dorset.

VIC-20 COMPUTER CASSETTE, extra RAM, intro, basic books, covers, software, as new, £170. Tel: 01-603 0363.

ZX81 with 16K RAM, plus many books and tapes, good condition, £30. Tel: Woking 71761 day; Camberley 22499 evenings.

FILER FOR BBC MICRO. Create your own data-files. Define the record format and FILER becomes a complete editor. Options include: Insert, Delete, Find/Load, Save, Sort and Jump. For Model A or B. FILER cassette has three programs, nine data-files. Send £12.50 for cassette, documentation and key card to: AEF, 53 Walsh's Manor, Stentonbury, Milton Keynes, Bucks.

BBC SOFTWARE CASSETTE No. 1. Lunar Lander and Attack, £5. Cassette No. 2: Adventure, £5. Both £3. K. P. Hammonds, 5 Rodborough Road, Dorridge, Solihull, W. Midlands.

CONVERT YOUR ORDINARY CASSETTE to run on VIC-20. Complete instructions, £2 + SAE. RMN, 3 Canberra Road, Shortstown, Bedfordshire.

VICMEN, AMOK, both 3.5K (one set only), £10. Ring row: 01-969 8374.

ZX81 16K, proper keyboard and case, leads, manuals, various games, tapes, £85. Tel: Brown, 581-423 1166, day-time.

ACORN ATOM 12K + 12K. Nearly new with improved keyboard + PSU + Games, £190. Tel: 01-868 5654.

ZX81 KITS, Inverse Video £2.65, built £3.55; repeat key £3.75, built £4.95. Memory crashes and log line start cured, £2.95 plus 40p post and packing. B. A. Reader, 45 Alfred Street, Kings Heath, Birmingham B14 7HG.

ZX81 16K plus over £50 of tapes and books, including ICL programme course, £100 inc. J. Hall, Tel: (0638) 55451.

VIC-20 with Arlon expansion unit, 23K RAM cassette and software, £450. Tel: Nigel, 0203 442979.

ZX81 16K, excellent condition, two books plus many tapes, £75. Tel: 01-471 3364.

ZX81 16K RAM, DK, Tronics Graphic ROM, 2K UDG available, PSU, leads, etc., books, software, 3 months old, real bargain, £95. Tel: Hosham 57117.

ZX81 16K RAM (still in package) with joystick, 16K tapes, and books, only two months ago, vgc, £100. Tel: Ingham 42863.

VIC-20 and VIC cassette plus programming book. Cost £235, will deliver anywhere in London. £200 wanted. Tel: Doug — 01-789 6160.

ZX81 SLEEP. Provides audible feedback. Improves your keyboard cheaply. Fits inside Simple plug-in; no soldering connections. Adds faster more accurate programming. £8.95 includes instructions, P&P + VAT. Fulcrum Products, Dept. W, Hilsdale, Steep Lane, Finton, W. Sussex.

TRS-80 16K LB. Includes keyboard, numeric keypad, leads, box, module, amplifier and £500 worth of software (games, utilities), only 10 months old. Tel: (Daniel) 01-349 9061 evenings.

PACMAN on BBC Micros A and B. Addictive arcade game on cassette. Send £4.90 to J. Pryce, 39 Nether Curve Road, Currie, Edinburgh EH14 5HX.

16K ZX81 plus many program cassettes, chess, finance, adventures, console, £130. Tel: 021-553 6734.

VIC-20 (UNEXPANDED) PROGRAMS: 8 Asteri, Collision, Infection, Car race, A-maze-ing, Pinball, all six for £2.95. A. Spencer, 230 Low Grange Avenue, Bilingham, Cleveland.

CLASSIFIED ADVERTISING RATES:

Line by line: For private individuals, 20p per word, minimum 10 words.

For companies, traders, and all commercial bodies, 40p per word, minimum 20 words.

Semi-display: £10 per single column centimetre, minimum length 3 cm. (Please supply A/W as PMT. Or supply rough setting instructions.)

Popular Computing Weekly will give you one free classified or semi-display advertisement for every two booked.

Conditions: All copy for Classified section must be pre-paid. Cheques and postal orders should arrive at least two weeks before the publication date. If you wish to discuss your ad, please ring Alastair Macintosh 01-630 3840.

Here's my classified ad.

(Please write your copy in capital letters on the lines below.)

| | | | |
|--|--|--|--|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Please continue on a separate sheet of paper.

I make this words, at per word so I owe you £

Name

Address

Telephone

Please cut out and send this form to: Classified Department, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2

Acorn quells fears over BBC delivery

ACORN have confirmed their commitment to fulfil orders for the BBC Model B by mid-August.

However, orders from as long ago as November 1981 still remain unfulfilled.

An Acorn spokesman explained that a "very large number" of the B models were shortly to be produced.

He said that the delivery dates being given to would-be owners by BL Marketing were

unduly pessimistic, being based on "current production figures".

To ease the difficulties, some Model As are being converted to Model Bs.

However, the main Model A manufacturer, Clearstone Electronics, has now been sold to the AB Electronic Products Group.

The purchase, for an estimated £250,000, ends a period of uncertainty for Clearstone, formerly in receivership.



The BBC's much-awaited micro.

Henry Kroch, AB's chairman, said: "Production of the machine will continue and benefit from the takeover."

AB Products Group, founded in 1935, had a turnover of over £21m in 1981.

John Radcliffe, of BBC Continuing Education, said the Corporation was "delighted that a firm financial base had been found for the Clearstone operation".

Fewer make a show of it

Despite being more than twice the size of last year's show, only 8,000 visitors attended the 3rd International Commodore Computer Show (June 3-5).

Those who came, 3,500 less than in 1981, saw the largest single-manufacturer show yet staged in the UK.

A Commodore spokesman said: "Despite the sweltering heat, in commercial terms, the show was a resounding success."

The outstanding feature — apart from the first UK appearance of the Vic-20 — was the large number of exhibitors displaying Vic-20 software.

Jack Tramiel, Commodore's Chief Executive, praised British companies. He said: "The show reaffirms my belief that the UK leads the world in micro software expertise."

ZX82 back in full production

Manufacture of the Spectrum has now been restarted, following the production set-back reported in last week's issue.

The first production batch, which was returned to Timex, has been modified and was dispatched from Dundee on June 8.

The exact size of the delivery is not clear, but estimates suggest "several thousand" units are now on their way to buyers.



Vic-20 software proved to be the big hit of the show.

Commodore hijacks Spectrum to America

Robin Bradbeer, co-editor of the Sinclair Spectrum manual and one-time education consultant to Commodore, has lost his Spectrum to America without his permission!

The heist happened at the Commodore Show. Bradbeer said: "People were interested in seeing the Spectrum so I took mine to show them."

"I took it in on Friday and Kit Spencer (Vice-President, Commodore Marketing) asked if he could borrow it overnight. I reluctantly said

OK and arranged to get it back from him at the show at 11.30 on Saturday.

"I waited around but he never turned up. At 4 o'clock they told me that Kit had got the 11 o'clock flight back to the States."

Bradbeer is considerably embarrassed by the proceedings and is "very, very angry".

He said: "I just walked out with a Vic and a colour tv from the exhibition and I said 'I'm taking these till you give me my Spectrum back'."

Ad leaflet ejected

Leaflets advertising the Sinclair Spectrum were unceremoniously ordered out of the Commodore show in London on June 3.

The leaflets were an insert into Micro Forecast, the free fortnightly computer news-paper.

An organiser told the company that if they didn't take the leaflets out of the newspaper he would shut the stand down in 15 minutes.

Sinclair aims for the main stream

Sinclair Research is to produce a new up-market machine.

The micro, as yet unnamed, is to be aimed at the mainstream business user.

It will incorporate the new ICL flat-screen terminal, full colour and extra memory. The machine uses Sinclair Basic and single-key word entry.

Development of the machine is well advanced and pre-production machines are on trial with certain business users for evaluation.

The new micro will sell for less than £350.

A machine that speaks

Wideband Products has just launched a new speech synthesizer.

The unit connects to the micro through an 8-bit parallel port and can be used with most machines including the BBC and PET.

Unlike some types of synthesizers, the Wideband model does not have a particular dictionary of words that it can generate but, instead is capable of being instructed to say anything. This is because the machine is programmed to recognise phonetic groups rather than whole words.

Each word is fed in as a series of sound groups. In the basic model it is necessary to key in code numbers associated with the various sounds, and a dictionary is supplied listing the phonetic groups and their codes.

A software package is also available which enables the synthesizer to recognise the phonetic letter-groups directly.

Wideband is currently working on an advanced application for the Anglia Water Authority. The speech synthesizer is incorporated in a unit which will be placed on a river bank. Sensors in the water monitor conditions, such as pollution level or water height.

The basic model is £69 and the additional software pack is £10 (both exclusive of VAT).

Chrisalid - BERKHAMSTED'S COMPUTER STORE

Watch this space for the real computer BARGAINS every week: EPSON MX801/t £355+VAT — EPSON

MX80 tractor only £315+VAT
VIC20 at £173+VAT
VIC cass
unit £39+VAT — range of VIC software.
11 x 9½ fanfold paper at £16.50 per 2000 sheets

GENIE 1 & 2 @ £289+VAT — All GENIE mods expansion/disks/mem.
CUMANA disk drives at £199 single and £369 double — 9" 12MHz monitors for only £99+VAT (metal).

OFFICIAL DEALERS FOR: Nascom, Genie, Cumana, Vic, and lots more — RING US NOW on BERKHAMSTED (04427) 74569 or 5704

12113 HIGH STREET
VISA BERKHAMSTED HP4 2HY
HERTFORDSHIRE



STOP PRESS
ZX81
16K RAM
NEW LOW PRICE!
£19.95

FULLY COMPATIBLE, BLACK CASE, GOLD CONNECTOR.

■ ASSEMBLED _ TESTED _ GUARANTEED ■

Cheque/P.O.s to:
PLESSIS ELECTRONICS, CASTLE HOUSE, OLD RD,
LEIGHTON BUZZARD (beds), LU7 7RG.

PLEASE ADD. £1.55 P.P

14 DAYS DELIVERY



MAKE THE MOST OF YOUR MICROCOMPUTER WITH OUR POPULAR RANGE OF PROVEN BOOKS—

GETTING ACQUAINTED WITH YOUR ZX81, by Tim Hartnell. Eighty plus programs in this 128-page book, including draughts. £5.95

20 SIMPLE ELECTRONIC PROJECTS FOR THE ZX81 and other computers by Stephen Adams £6.45

MASTERING MACHINE CODE ON YOUR ZX81 OR ZX80, by Tom Baker. 180 pages, teaches machine code from first principles. £7.50

49 EXPLOSIVE GAMES FOR THE ZX81, edited by Tim Hartnell. £5.95

34 AMAZING GAMES FOR THE 1K ZX81 by Alastair Gourlay £4.95

THE GATEWAY GUIDE TO THE ZX81 AND ZX80, by Mick Charlton. Over 60 programs and routines. ZX BASIC explained in detail. £6.45

LEARN PASCAL ON ZX81 ZX SPECTRUM OR BBC MICRO-COMPUTER WITH 'PASCAL FOR HUMAN BEINGS', by Jeremy Ruston, which contains a 12K compiler so you can run a limited version of Pascal on your ZX81, ZX Spectrum or BBC Microcomputer. Book plus compiler listing. £4.95

LET YOUR BBC MICRO TEACH YOU TO PROGRAM, by Tim Hartnell, over 40 programs, BBC BASIC from first principles. £6.45

THE BBC MICRO REVEALED, by Jeremy Ruston. The full story on the BBC Microcomputer for the serious user. £9.95

GETTING ACQUAINTED WITH YOUR VIC 20, by Tim Hartnell, with over 60 programs to get your VIC up and running from day one. £6.95

SYMPHONY FOR A MELANCHOLY COMPUTER by Tim Hartnell. 24 great Vic games. £6.95

39 TESTED PROGRAMS FOR THE ACORN ATOM Best of Interface edited by Tim Hartnell. £6.45

GETTING ACQUAINTED WITH YOUR ACORN ATOM, by Trevor Sharples and Tim Hartnell. 184 pages, 80 programs, including draughts. £7.95

INTERFACE, the monthly magazine published by the NATIONAL ZX USERS' CLUB is just £9.50 (UK) £12.50 (Europe) for 12 issues. Sample copy, with many programs for your ZX computer, book software and hardware reviews, education, contact addresses, just £1.

*All ZX81 books now contain Spectrum supplement, not available separately. All our ZX81 programs will run on your ZX Spectrum.

Please send me the items marked I enclose £

Name: _____

Address: _____

Please make cheques payable to INTERFACE and send the above form, or a copy, to: INTERFACE, Dept. PC, 44-46 Earls Court Road, London W8 6EJ

Please allow up to 28 days for delivery

Club Reports

Watching and waiting in Manchester

David Kelly reports on the first ZX fair to take place outside London

Summer may be said to be smiling on Britain now but at traditionally wet Manchester the arrival of the sun cast a shadow over the ZX Microfair.

It was the first such event to be staged outside London. The weather was dazzling and the people stayed away in droves.

As with the last London show, the fair — at the New Century Hall May 29-30 — was spread over two days. There were more than 50 exhibitors and plenty to see, so why was the attendance down to few more than 2,000 for the two days? And why was it that many of the exhibitors commented on the slowness of sales?

Mike Johnston, the ZX Microfair organiser, was able to pin-point several possible reasons.

The most noticeable feature of the show, he said, was the influence of the Spectrum launch, both on the visitors and the exhibitors.

He was quite pleased with the turn-out, particularly on the Saturday, but the uncertainty generated following the Spectrum launch resulted in fewer purchases.

Mike felt the attendance was about right, since the New Century Hall had been chosen to accommodate the sort of numbers that turned up.

When he had been setting up the show in January, he had wanted to include as many local companies as possible. In the event, about one third of the stands represented firms operating in the region.

Rumours of a ZX81 price reduction and uncertainty in the Spectrum delivery dates left most people a little bewildered.

Few exhibitors could be sure of their plans while the Spectrum remained undelivered and the same applied to the buyers.

Mike Johnston is very much aware of the situation. He is going ahead with his next London show, at the New Horticultural Hall in August, but will delay the next regional show, planned probably for Bristol or Southampton, until after the Spectrum is established.

He believes the current mood of despondency cannot last. "People said just the same when the ZX81 was launched — and now look at the number of add-ons and products available for it. Exactly the



Moving in for a closer look ... some of the visitors at the Manchester show



And, at times, jostling for position

same will be true of the Spectrum in a couple of months time."

Of the Manchester show, Mike says: "It seems that anything less than the fantastic success we had in the first London show is regarded as a disaster!"

He did not believe that the response in Manchester would alter his plans for future ZX fairs.

The idea of the fairs has always been to put companies and ZX owners together — and to do so as cheaply as possible. It has been important to keep the entrance fee as low as possible — 60p for adults — and to minimise the expenses to exhibitors.

The cost of a stand at Manchester — £25 — was deliberately kept down to

encourage small businesses which are just beginning to trade.

The next London Show, at the New Horticultural Hall, will be for one day only and in a much bigger venue. The hall has 20,000 sq ft of space, all in one area, so there will be plenty of room for stands and visitors.

Again the show will favour the smaller trader, who will benefit from the lower cost of a one-day event.

Mike hopes that this will result in a show with much interest and variety, but it will be interesting to see what the response from the various ZX businesses will be. Many traders at Manchester had been very disappointed with the attendance and their sales.

The New Horticultural Hall ZX Microfair will be held on Saturday August 31.

For further details contact Mike Johnston, 71 Park Lane, Tottenham, London N17.

What's happening

Manchester Acorn User Group meets fortnightly (during school term time only) on Tuesdays at 7 pm in the Abraham Moss Centre, Chetham. The next meeting will be on June 22. Either telephone (daytime) Barry Pickles on 061-834 1234 or (evening) John Ashurst on 061-681 4962 or write to Barry Pickles, 1 Cromhall Walk, Manchester M8.

North London BBC Micro Users Group is being formed. It is hoped that the group will hold fortnightly meetings once a suitable venue has been found. All interested parties and potential members should get in touch with Jeremy San, 73 Uphill Road, Mill Hill, London NW7. (Tel: 01-959 0114).

Crawley ZX81 Users Club meets every Monday, nearly all the year round (including school holidays) in the Science Laboratory, Ifield School, Lady Margaret Road, Ifield, Crawley, Sussex. The club meets between 7 pm and 9 pm. Membership is £3 per year and the first meeting is free. Contact John Heron, Club Secretary, 23 Pelworth Court, Bewbush, Crawley, Sussex. (Tel: 0293 518396).

Southern Gas Micro Club is open to any employee of Southern Gas. The club meets at the Southern Gas RHQ, 80 St Mary's Road, Southampton, and has access to ZX81s, a Vic-20, an Acorn Atom and BBC machines. In addition the club produces Microcosm, a newsletter containing club news, reviews and programming hints and articles. Contact Ian Smith, Floor A1, Management Services, Southern Gas RHQ, 80 St Mary's Road, Southampton.

COVER STORY

Shark Attack

You are a missile-base commander in the suburbs of Atlantis. Your mission is to destroy as many sharks as possible with your 20 missiles. You command three numbered silos, and choose your firing point via the corresponding keys 1-3.

The shark circles at the top of the screen, on the other side of a strong and unpredictable current. The shark doesn't bite, but dies quite aggressively when hit.

The code-loader program, and the 10 REM (122 X's) are keyed in first and RUN. Next, enter the machine code one byte at a time. The machine code loader will be overrun by the actual program when you key it in, but it is a good idea to SAVE at this point, just in case.

The program uses the whole screen by poking on to the bottom line the status of your missile dump, which decreases as each missile is fired. At the end of the game, your score and a rating are displayed.

The actual machine code is merely a quick-draw subroutine, which I adopted in an effort to speed up my program. I also experimented with true/false equations, which can, as in line 350, take the place of four lines of IF/THEN statements.

If you happen to bob the shark's tail as it approaches from the right, it does not die. This is because the check for a hit in line 430 PEEKs the position directly to the right of the missile when it reaches line 1. If

it PEEKs a space, the "death plunge" is avoided.

Program Listing: "SHARK"

```
10 REM (122 X's)
20 LET A = 16514
30 INPUT B
40 POKE A, B
50 PRINT B: " "
60 GOTO 30
Machine code:
```

```
16514: 255
      6
      0
      186
      64
      237
      91
      121
      64
      42
      12
      64
      25
      229
      237
      91
      133
      64
      26
      19
      193
```

```
182
16536: 50
      64
      254
      0
      40
      2
      34
      4
      0
      24
      1
      26
      2
      124
      40
      1
      149
      200
```

```
16558: 229
      26
      38
      0
      111
      1
      229
      193
      1
      19
      24
      222
      19
      131
      1
      155
      131
```

```
1
7
0
132
1
128
3
1
128
1
138
13
0
1
7
103
1
0
10
0
1
132
131
1
155
16599: 131
```

```
29
0
1
137
1
128
1
131
1
130
30
13
0
1
151
0
1
3
1
130
999
16618: 1
```

```
Actual program: "SHARK"
20 LET B = 0
30 LET B = 19
40 LET E = (PEEK 16390
+ 256 * PEEK 16397) +
768
50 POKE E, 30
60 POKE E + 1, 50
70 POKE E + 2, 50
80 POKE E + 3, 52
90 POKE E + 4, 14
```



A new game for the 16K ZX81

by Dave McGuire

```

10 REM XXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
XXXXXXXXXXXXXXXXXXXXXXXXXXXXX
100 LET A=16514
30 INPUT B
40 POKE A,B
50 PRINT B;"-";
60 GOTO 30
20 LET S=0
30 LET B=19
40 LET E=(PEEK 16396+256*PEEK
16397)+768
50 POKE E,B
60 POKE E+1,B
70 POKE E+2,B
80 POKE E+3,B
90 POKE E+4,B
100 FOR O=0 TO 8
110 POKE E+O+5,157
120 NEXT O
130 POKE 16517,156
140 POKE 16518,3
150 POKE 16519,0
160 PRINT AT 20,0;"SCORE "
170 PRINT AT 21,5;"E"
180 PRINT AT 21,0;S
190 LET P=1
200 LET X=3
210 LET T=0
220 IF B<0 THEN GOTO 530
230 IF INKEY$="" THEN GOTO 320
240 LET B=B-1
250 LET T=VAL INKEY$
260 LET M=(T-3)*10+7
270 POKE E+5,B
280 FOR U=3 TO 1 STEP -1
290 IF (RND*41)*3 THEN LET M=M-1
300 PRINT AT U+1,(ABS M)-1+(M=0)
110 PRINT AT U,H;"1"
320 POKE 16515,X
330 RAND USR 16519
340 RAND 0
350 LET X=X+(P=0)+(X=1)-(X=27)-(P=1)

```

```

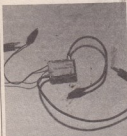
360 LET P=P-(X=2)+(X=26)
370 LET Y=156
380 IF P=0 THEN LET Y=206
390 POKE 16517,Y
400 IF T=0 THEN GOTO 220
410 NEXT U
420 PRINT AT U+1,H;"- "
430 IF PEEK ((PEEK 16396+256*PEEK
EX 16397)+1ABS M)+1)=0 THEN GOTO
210
440 POKE 16517,226
450 FOR Z=X TO (629+X) STEP 33
460 POKE 16518,INT (Z/256)
470 POKE 16515,Z-256*PEEK 16518
480 RAND USR 16519
490 NEXT Z
500 LET S=S+1000
510 CLS
520 IF B)=0 THEN GOTO 50
530 CLS
540 LET C=5/1000
550 IF C=1 THEN PRINT TAB 3;"YOU
U KILLED 1 SHARK FOR"
560 IF C<1 THEN PRINT TAB 3;"YOU
OU KILLED ";C;" SHARKS FOR"
570 PRINT
580 PRINT TAB 8;S;" POINTS"
590 IF C=0 THEN LET D$="ITHE SH
ARK IS THE BLACK THING I"
600 IF C=1 THEN LET D$="SHARK S
AIT"
610 IF C=2 THEN LET D$="TAKE UP
KNITTING"
620 IF C=3 THEN LET D$="NOT BA
D,NOT BAD"
630 IF C)=5 THEN LET D$="IF I H
AD EMOTIONS I WOULD BE HILDLY IN
PESSED"
640 IF C)=7 THEN LET D$="CAPTAIN
HERO UNITS TO KISS YOUR FEET"
650 IF C)=9 THEN LET D$="POSEID
ON, I PRESUME?"
660 IF C)=11 THEN LET D$="HAVE
HERCY ON THEM...GEEZ"
670 IF C)=13 THEN LET D$="SHARK
S ARE AN ENDANGERED SPECIES"
680 IF C)=15 THEN LET D$="HAVE
YOU MADE ANY FACTS WITH HORNED S
EINGS LATELY?"
690 PRINT AT 10,10;"*RATING*"
700 PRINT
710 PRINT D$

```



Reviews

hardware



Box of noise . . . Telesound 82

Telesound 82

COMPUSOUND, 32 Langley Close,
Redditch, Worcs B98 0ET.
Tel: 0725-21439.
Price £9.95 including VAT.

This small metal box sticks on to the back of a ZX81 and enables you to put sounds through your TV speaker. It is connected to the ZX81 by three crocodile clips covered in insulated sleeves, so it can be removed at any time without damaging your ZX81. There is no soldering to be done and no holes to be made in the case.

Once the clips are fitted to the ZX81, the unit may be tested. The audio input to the Telesound 82 is via a 3.5mm jack plug fitted to nine inches of cable. It may be plugged into the output of a tape recorder, soundboard or even the MIC socket of the ZX81.

If you have no sound source then a test program is provided so that the unit can be adjusted with the ZX81 providing the sounds. A program is also included to turn the ZX81 into an electronic organ using the lower two rows of the keyboard.

Telesound 82 will produce sounds through the loudspeaker of a TV set whether or not a program is running. It will also work in FAST or SLOW modes. This can be used to advantage, as a tape giving instructions can be played through the TV, even before the program has been started.

The unit only draws a small current and should not cause any overheating problems with a Sinclair power pack. It does not require any RAM memory to operate and can be used on a 1K or 16K machine.

There were only two problems that I found with Telesound 82. First, the red and black connecting wires were a bit short. If you have one of the larger RAM packs that run along the back of the ZX81, then it could get in the way. Longer leads would

have allowed it to be mounted on the side or the top of the ZX81.

The other problem related to a keyboard bleeper that I have fitted to my ZX81. It also uses the TV Sync signal and the Telesound made this inoperative. I cured this by inserting a 49 ohm resistor in series with the green crocodile clip, allowing both units to work quite happily together.

The unit works best with the sound source volume control on full. Using the TV's volume control to adjust the sound level keeps the background noise down.

Conclusion

This unit makes games and educational uses of the ZX81 much more interesting. A separate amplifier is no longer necessary, as the TV's sound channel replaces it. The instructions are clear and easy to follow.

The two programs included with the kit are a FAST mode electronic organ routine and a short test program. Telesound 82 is excellent value for money and, I believe, the only one on the market. SA

RD system

RD Laboratories, 5 Kennedy Road, Dane End, Ware, Hertfordshire SG12 0LU. Tel: 0902 84380.

Prices: RD8100 £40; RD8101 £15; RD8110 £27.50.

The simplest RD system consists of an RD8101 micro-mum and an RD8110 eight bit input/output port. The motherboard is different from most in that it consists of 0.1mm spaced pins which stick up from the motherboard in two parallel rows. There is space for two modules on the RD8101, one on each row of pins.

If more modules are required, RD make the RD8100 which is an eight row motherboard in a case. This large motherboard has several advantages over the simple printed circuit board of the micro-mum. It is contained in a black plastic box, sloped towards you, and is fully buffered which means that there are chips built into the box to amplify the signals coming from the ZX80 or ZX81. This buffering allows the modules attached to the motherboard to be removed at any time without crashing the ZX computer.

The 16K RAM pack and printer can be connected to the back of either motherboard, so that any modules that you wish to use can also be connected here. An extra power supply for the motherboard can be plugged in to a power socket at the back, to relieve the strain on the ZX81's own 5 volt regulator.

The RD8110 provides eight input wires and eight output wires of a memory mapped port which can be used in a variety of

ways. This port is one of the few that is fully decoded, so that it occupies one address and can be treated like a piece of RAM.

The address of the port can be set to one of 16 addresses between 15552 and 15567 by inserting a wire in a five pin socket on the underside of the module. The connections to the port can be made in two ways, by poking bare wire into the sockets on top of the module or by plugging in easily available 0.1mm Molex pinned blocks. No soldering is required.

The booklet that accompanies each part of the system explains what you can do with the port, from using a 64 key keyboard to a remote testing facility.

The RD8100 is, I believe, a very good system for the experimenter or for school. You can add as many modules as you require and it does not take an electronics genius to use them. SA

Info and Data

By Barbara and John Jaworski, published by Nelson, 206 pages, paperback. Price £6.95.

Every user of a home computer comes to the time when he or she wants to learn more about computers. When the games pall or the struggles at unstructured programming cease, relax in a chair with this excellent background book.

Computers: Information and Data was written specifically for school and college use, but do not let that put you off. For one thing, text-books are a good starting point for picking up a basic knowledge of almost any field. Also, this book is the best CSE/Ordinary level computing text-book that I have come across. It is certainly tougher going than some, and has few pictures, but it covers the material carefully and thoroughly.

One point to note is that this book does not include material on programming. This is normal educational practice — different people have different approaches to programming and different machines to program. For similar reasons the authors do not cover the history, logic and social impact of computers.

There are chapters on the nature of the digital machine, data, storage, files, hardware, software, systems analysis, programming approaches, processing and applications. The book has plenty of examples and exercises, and the index is excellent.

In every way this is a most useful book whether you are interested in computers for personal or educational reasons. And it comes at a school-book price — good value in other words. K.

Reviews

software

ZXAS

Bug-Byte Software, 98-100 The Albany,
Old Hall Street, Liverpool.
ZX81 16K cassette.
Price £5.00

ZXAS is an assembler for the 16K ZX81, which is written in machine code. The program is 5K long and when run relocates itself in the top five k of ram and reduces RAMTOP by five k. A small BASIC portion of the program inputs the start location of the machine code and calls the assembler.

Standard Zilog mnemonics are used, with the exception of commas which are replaced by full stops. If the operations are separated by semicolons, more than one can be placed in the REM statements which hold the object code. However, this can make debugging a bit harder.

Two hundred and fifty-six labels are allowed, imaginatively called L0 to L255. These are distinguished by placing a colon before them. The assembler is two-pass and jumps using labels are calculated on the second pass.

The assembler works extremely quickly assembling 20 instructions as the screen is displayed, which takes less than one second. The operation codes and locations in hex are displayed, along with the mnemonics and the codes original REM statement.

The program seems bug-free and only has one real fault. This is the lack of a routine to save assembled code on to tape, unless the code is first put in a REM statement.

The program loads well in about two and a half minutes. But the casing on my copy was slightly distorted, so it has to be pressed firmly into the recorder. This could cause some tape problems, but the tape itself sounds OK.

Summary

A well-thought-out product, which is useful to anyone who is seriously interested in machine-code programming on the ZX81.

AE

Fun To Learn

Available from W H Smith branches, or direct from Sinclair Research, Freepost, Camberley, Surrey GU15 3BR.
ZX81 16K cassette.
Price £6.95.

If you go into your local W H Smith, you will see the sombre brown and yellow stripes of the ICL "Fun To Learn" series of software. There are 8 of these tapes, and

they form a large part of Sinclair's latest release of software for the ZX81. The tapes are:

- E1: English Literature 1 and 2
- E3: Geography
- E4: History
- E5: Mathematics
- E6: Music
- E7: Inventions
- E8: Spelling

Most of these programs take the form of a race between 1 to 4 people, with a menu of about half a dozen categories within the main subject. For instance, the History program will give you the choice of answering questions on, among others, "Monarchs of Britain", "When Did He Reign" and "Pot Luck". Questions are then set, with multiple-choice answers. There is also a teaching mode in some subjects, in which the computer runs through salient points of the subject, with dates and various other informative notes.

The Geography program is designed for one person only, and displays a map of England or Europe. The user then answers questions about the towns of England, or the countries and capitals of Europe. The computer will also run through the locations of these on the maps, in the teaching mode.

Mathematics is set at four levels in each of the four basic disciplines of addition, subtraction, multiplication and division.

Spelling is a test for 6- to 11-year-olds. Sentences are spoken, and words within that sentence tested. The correct spelling will then appear, and the pupil goes on to the next sentence.

Summary

Attractively boxed and easily loaded, the programs are, however, slightly overpriced. Many of the programs share the same basic algorithm. Even though expert knowledge must have been sought to set the questions, the duplication of programs should have brought the price down by a pound or two.

The questions are fairly difficult, and would probably appeal more to older teenagers and adults when used as a General Knowledge Quiz rather than in a strictly classroom environment.

It must be admitted, however, that younger children recognise even the harder questions as they come round for the fourth or fifth time. Unfortunately there is no textbook to refer back to and gain further knowledge. Having learnt that disc brakes were invented in 1902, but were not in general use until 1960, it would be nice to know why.

Spelling mistakes occur occasionally, but are probably due to careless typing. There are one or two more serious mistakes, such as Sir Arthur Bliss's inclusion

in the section on Opera, when Bliss did not write any Operas.

ICL's next addition to their educational range should be a Modular program that would enable the users to set their own questions — there being only a limited amount of data in existing programs.

AB

A-maz-ing Vic Pack

Audiogenic Ltd, PO Box 88, 34-36 Crown Street, Reading.
Vic-20 3K cassette.
Price £6.99 (including VAT).

A-maz-ing is yet another version of the Pac-Man arcade game. The Gobbler wanders around a maze, side-stepping unfriendly ghosts and eating lots of little dots. Quite where it puts them is hard to discover — it is obviously one of those voracious creatures that can eat its own weight, several times over.

In the US the original Atari arcade version coined over \$1 billion in its first year. But, on the strength of this Audiogenic version, it is hard to see why.

The major disadvantage of A-maz-ing is that it soon becomes a walk-over. When the program is first run, everything is fine. After a short while, however, the Gobbler becomes rather easy to control, particularly when using the joy-stick option.

Another problem is that the ghosts do not seem that unfriendly. They prefer to remain somewhat aloof and are not terribly bothered by the ravenous Gobbler. You can quite happily sneak up behind a ghost and chomp the blobs there, secure in the knowledge that the ghost will take some time to turn round.

The game does, however, contain all the features of the original. If you are unlucky enough to be cornered by a ghost, you have no hope and must forfeit one of your three lives.

But, you can turn the tables on the ghosts by eating one of the four power dots in the maze. This sounds a tone and causes the ghosts to change colour. It is then possible to eat the ghosts, until the power runs out and the ghosts revert to their normal colours.

The more blobs you eat, the more points you are awarded, with bonuses for swallowing power dots or ghosts.

Basic instructions and the key-board controls are explained on the insert supplied with the cassette.

Summary

The Vic-Pack version is a little short of A-maz-ing, but it will undoubtedly appeal to Pac-Man enthusiasts.

DK

Open Forum

from previous page

finds the position of the most significant bit while the second loop works out the remaining least significant bits.

Big letters

on Vio-20

The program scrolls a message of the user's choice up the screen in large 8x8 letters. Here's how it works:

Lines 5 to 4 print the instructions.
Lines 5 to 7 input the message, print it at the top of the screen and set up the variables.
Line 8 puts the screen codes of the message into an array and sets the print position to the centre of the screen.
Lines 9 to 100 PEEK the character generator, convert the number to binary and then to a series of inverse spaces which make up the characters.

```
140 REM LEADING ZEROS ARE NOT DISPLAYED
150 REM
160 A$=""
170 INPUT"ENTER DECIMAL "N
180 IF N<1 THEN 160
190 N=INT(N)
200 A=A$+I:I=1
210 R=N-I
220 IF R<1 THEN 250
230 I=I*2
240 GOTO210
250 I=I/2
260 A$=A$+RIGHT$(STR$(A),I)
270 IF I<1 THEN PRINT"BINARY = ";A$:GOTO160
280 IF R>I THEN A$=A$+R-I:GOTO250
290 A$=A$+GOTO250
```

Big letters
by Martin Howse

```
0 PRINT"c BIG LETTERS"
1 PRINT"ddTHIS PROGRAM WILL ASK dYOU TO ENTER SOME dWORDS
AND IT WILL"
2 PRINT"dSCROLL THE WORDS IN dLARGE LETTERS UP THE dSCREEN.YOU
MAY HAVE"
3 PRINT"dCOLOUR LETTERS BY dPRESSING CTRL AND THE dCOLOUR WANTED
WHEN YOU"
4 PRINT"ENTER THE WORDS.":FORF=1TOS000:NEXT
5 PRINT"dddddPLEASE ENTER MESSAGE":FORJ=1TOS000:NEXT:PRINT"c":INPUTA$
6 A$=" "+A$1:PRINT"c":I=A$
7 AA=LEN(A$):DIMA(AA+1)
8 FORI=0TODAA-1:A(I)=PEEK(7680+I):NEXT:PRINT" "
9 FORH=0TODAA-1
10 FORF=32768+A(H)+8TOS32775+A(H)+8:A=PEEK(F):FORG=1TOS
20 READB:IFA-B)=0 THEN A=A-B:PRINT"r o":NEXTG:PRINT"dbbbbbbbb":RESTORE:
NEXTF,H
30 PRINT" ":NEXT:PRINT"dbbbbbbbb":RESTORE:NEXTH:GOTO5
100 DATA128,64,32,16,8,4,2,1
```

N.B.

Because the printer cannot handle graphics. The following VIC cursor controls have been replaced by lower case letters.

c-CLEAR d-CURSOR DOWN r-REVERSE ON o-REVERSE OFF
b-CURSOR BACK

Efficient scrolling

on ZX81

by Peter Sandford

The SCROLL command provides a particularly effective means of display for 'adventure' types programs. Unfortunately, the command requires a separate program line each time it is used, and cannot be incorporated within PRINT statements. In lengthy programs, this can be extremely expensive in terms of memory.

The following machine code routine, which requires 4K+ RAM, overcomes these limitations and allows the display to be scrolled as many times as required within any one program line. Provided the start address of the routine is defined as a single letter variable at the beginning of the program, substantial memory savings can be achieved.

```
START 2A 0C 40 LD HL, (d-FILE)
54 LD DH, (d-FILE)
50 LD EL, (d-FILE)
01 21 00 LD BC,21h
09 ADD HL,BC
01 05 02 LD BC,0255h
02 00 LDR
```

```
13 INC DE
ED 03 0E 40 LD(DF-CC),DE
21 21 00 Set system variables to print
LD HL,0321h
22 39 40 at start of line 21
06 20 LD(S-POSN),HL
LD B,20h
87 Clear line 21
12 SUB A
13 LD (E),A
19 INC DE
09 DJNZ LOOP
C9 RET
```

The routine should be stored in a 33 byte REM statement in program line 1. Run the following BASIC program, and enter each

New ZX81 Software from Sinclair.

A whole new range of software for the Sinclair ZX81 Personal Computer is now available – direct from Sinclair. Produced by ICL and Psion, these really excellent cassettes cover games, education, and business/household management.

Some of the more elaborate programs can only be run on a ZX81 augmented by the ZX 16K RAM pack. (The description of each cassette makes it clear what hardware is required.) The RAM pack provides 16-times more memory in one complete module, and simply plugs into the rear of a ZX81. And the price has just been dramatically reduced to only £29.95.

The Sinclair ZX Printer offer full alphanumeric and highly-sophisticated graphics. A special feature is COPY which prints out exactly what is on the whole TV screen without the need for further instructions. So now you can print out your results for a permanent record. The ZX Printer plugs into the rear of your ZX81, and you can connect a RAM pack as well.

Games

Cassette G1: Super Programs 1 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Invasion from Jupiter. Skiffles. Magic Square. Doodle. Kim. Liquid Capacity.

Description – Five games programs plus easy conversion between pints/gallons and litres.

Cassette G2: Super Programs 2 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Rings around Saturn. Secret Code. Mindboggling. Silhouette. Memory Test. Metric conversion.

Description – Five games plus easy conversion between inches/feet/yards and centimetres/metres.

Cassette G3: Super Programs 3 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Train Race. Challenge. Secret Message. Mind that Meteor. Character Doodle. Currency Conversion. Description – Five games plus easy conversion at will – for example, dollars to pounds.

Cassette G4: Super Programs 4 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Down Under. Submarines. Doodling with Graphics. The Invisible Invader. Reaction. Petrol.

Description – Five games plus easy conversion between miles per gallon and European fuel consumption figures.

Cassette G5: Super Programs 5 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Martian Knock Out. Graffiti. Find the Mate. Labyrinth. Drop a Brick. Continental.

Description – Five games plus easy conversion between English and continental dress sizes.

Cassette G6: Super Programs 6 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Galactic Invasion. Journey into Danger. Create. Nine Hole Golf. Solitaire. Daylight Robbery.

Description – Six games making full use of the ZX81's moving graphics capability.

Cassette G7: Super Programs 7 (ICL)

Hardware required – ZX81.

Price – £4.95.

Programs – Racetrack. Chase. NIM. Tower of Hanoi. Docking the Spaceship. Golf.

Description – Six games including the fascinating Tower of Hanoi problem.

Cassette G8: Super Programs 8 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £4.95.

Programs – Star Trail (plus blank tape on side 2).

Description – Can you, as Captain Church of the UK spaceship Endeavour, rid the galaxy of the Klingon menace?

Cassette G9: Biorhythms (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – What are Biorhythms?

Your Biorhythms.

Description – When will you be at your peak (and trough) physically, emotionally, and intellectually?

Cassette G10: Backgammon (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Programs – Backgammon. Dice.

Description – A great program, using fast and efficient machine code, with graphics board, rolling dice, and doubling dice. The dice program can be used for any dice game.

Cassette G11: Chess (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Chess. Chess Clock. Description – Fast, efficient machine code, a graphic display of the board and pieces, plus six levels of ability, combine to make this one of the best chess programs available. The Chess Clock program can be used at any time.



Cassette G12: Fantasy Games (Psion)

Hardware required – ZX81 (or ZX80 with 8K BASIC ROM) + 16K RAM.

Price – £4.75.

Programs – Perilous Swamp. Sorcerer's Island.

Description – Perilous Swamp: rescue a beautiful princess from the evil wizard Sorcerer's Island: you're marooned. To escape, you'll probably need the help of the Grand Sorcerer.

Cassette G13: Space Raiders and Bomber (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £3.95.

Programs – Space Raiders. Bomber. Description – Space Raiders is the ZX81 version of the popular pub game.

Bomber: destroy a city before you hit a sky-scraper.

Cassette G14: Flight Simulation (Psion)

Hardware required – ZX81 + 16K RAM.

Price – £5.95.

Program – Flight Simulation (plus blank tape on side 2).

Description – Simulates a highly manoeuvrable light aircraft with full controls, instrumentation, a view through the cockpit window, and navigational aids. Happy landings!

Education

Cassette E1: Fun to Learn series – English Literature 1 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Novelists. Authors.

Description – Who wrote 'Robinson Crusoe'? Which novelist do you associate with Father Brown?

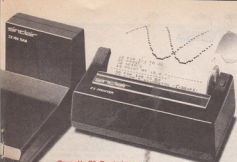
Cassette E2: Fun to Learn series – English Literature 2 (ICL)

Hardware required – ZX81 + 16K RAM.

Price – £6.95.

Programs – Poets. Playwrights. Modern Authors.

Description – Who wrote 'Song of the Shirt'? Which playwright also played cricket for England?



Cassette E3: Fun to Learn series - Geography 1 (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £6.95.

Programs - Towns in England and Wales, Countries and Capitals of Europe.
Description - The computer shows you a map and a list of towns. You locate the towns correctly. Or the computer challenges you to name a pinpointed location.

Cassette E4: Fun to Learn series - History 1 (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £6.95.

Programs - Events in British History.
Description - From 1066 to 1981, find out when important events occurred. Recognise monarchs in an identity parade.

Cassette E5: Fun to Learn series - Mathematics 1 (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £6.95.

Programs - Addition/Subtraction, Multiplication/Division.
Description - Questions and answers on basic mathematics at different levels of difficulty.

Cassette E6: Fun to Learn series - Music 1 (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £6.95.

Programs - Composers, Musicians.
Description - Which instrument does James Galway play? Who composed 'Peter Grimes'?

Cassette E7: Fun to Learn series - Inventions 1 (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £6.95.

Programs - Inventions before 1850, Inventions since 1850.
Description - Who invented television? What was the 'dangerous Lucifer'?

Cassette E8: Fun to Learn series - Spelling 1 (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £6.95.

Programs - Series A1-A15, Series B1-B15.
Description - Listen to the word spoken on your tape recorder, then spell it out on your ZX81. 300 words in total suitable for 6-11 year olds.

Business/household

Cassette B1: The Collector's Pack (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £9.95.

Program - Collector's Pack, plus blank tape or side 2 for program/data storage.
Description - This comprehensive program should allow collectors (of stamps, coins etc.) to hold up to 400 records of up to 6 different items on one cassette. Keep your records up to date and sorted into order.

Cassette B2: The Club Record Controller (ICL)

Hardware required - ZX81 + 16K RAM.
Price - £9.95.

Program - Club Record Controller plus blank tape on side 2 for program/data storage.
Description - Enables clubs to hold records of up to 100 members on one cassette. Allows for names, addresses, phone numbers plus five lots of additional information - eg type of membership.

Cassette B3: VU-CALC (Psion)

Hardware required - ZX81 + 16K RAM.
Price - £7.95.

Program - VU-CALC.

Description - Turns your ZX81 into an immensely powerful analysis chart. VU-CALC constructs, generates and calculates large tables for applications such as financial analysis, budget sheets, and projections. Complete with full instructions.

Cassette B4: VU-FILE (Psion)

Hardware required - ZX81 + 16K RAM.
Price - £7.95.

Programs - VU-FILE Examples.

Description - A general-purpose information storage and retrieval program with emphasis on user-friendliness and visual display. Use it to catalogue your collection, maintain records or club memberships, keep track of your accounts, or as a telephone directory.

How to order

Simply use the FREEPOST order form below and either enclose a cheque or give us your credit card number. Credit card holders can order by phone - simply call Camberley (0276) 66104 or 21282 during office hours. Either way, please allow up to 28 days for delivery, and there's a 14-day money-back option, of course.

sinclair ZX81 SOFTWARE

Sinclair Research Ltd,
Stanhope Road, Camberley, Surrey,
GU15 3PS.
Tel: Camberley (0276) 66104 & 21282.

To: Sinclair Research, FREEPOST, Camberley, Surrey, GU15 3BR.
Please send me the items I have indicated below.

| Qty | Cassette | Code | Item price | Total |
|-----|----------------------------|------|------------|-------|
| | G1 Super Programs 1 | 30 | £4.95 | |
| | G2 Super Programs 2 | 31 | £4.95 | |
| | G3 Super Programs 3 | 32 | £4.95 | |
| | G4 Super Programs 4 | 33 | £4.95 | |
| | G5 Super Programs 5 | 34 | £4.95 | |
| | G6 Super Programs 6 | 35 | £4.95 | |
| | G7 Super Programs 7 | 36 | £4.95 | |
| | G8 Super Programs 8 | 37 | £4.95 | |
| | G9 Rhythms | 38 | £6.95 | |
| | G10 Backgammon | 39 | £5.95 | |
| | G11 Chess | 40 | £6.95 | |
| | G12 Fantasy Games | 41 | £4.75 | |
| | G13 Space Raiders & Bomber | 42 | £3.95 | |
| | G14 Flight Simulation | 43 | £5.95 | |
| | E1 English Literature 1 | 44 | £6.95 | |

| Qty | Cassette | Code | Item price | Total |
|-----|---|------|------------|-------|
| | E2 English Literature 2 | 45 | £6.95 | |
| | E3 Geography 1 | 46 | £6.95 | |
| | E4 History 1 | 47 | £6.95 | |
| | E5 Mathematics 1 | 48 | £6.95 | |
| | E6 Music 1 | 49 | £6.95 | |
| | E7 Inventories 1 | 50 | £6.95 | |
| | E8 Spelling 1 | 51 | £6.95 | |
| | B1 Collector's Pack | 52 | £9.95 | |
| | B2 Club Record Controller | 53 | £9.95 | |
| | B3 VU-CALC | 54 | £7.95 | |
| | B4 VU-FILE | 55 | £7.95 | |
| | ZX 16K RAM pack | 56 | £39.95 | |
| | ZX Printer | 27 | £59.95 | |
| | Post & packing - only if ordering hardware | | £2.95 | |

TOTAL £

I enclose a cheque/postal order to Sinclair Research Ltd for £

Please charge my *Access/Barclaycard/Trustcard no.

*Please delete as applicable.

Mr/Ms/Miss

Address

WS427

Open Forum

pair of hex codes in turn.

```
1 REM 33 zeros
10 FOR X=16514 TO 16546
20 INPUT AS
30 IF LEN AS<>2 THEN GOTO 20
40 SCROLL
50 POKE X,16:CODE AS+CODE AS(2)-476
60 PRINT X,AS
70 NEXT X
```

To see how the routine is used, delete lines 50 to 70, and add the following:

```
2 LET S=16514
10 PRINT TAB USR S: "THIS IS AN EXAMPLE";
TAB USR S: "OF THE USE OF THIS
SUBROUTINE"; TAB USR S: TAB USR S
20 FOR I=1 TO 50
30 NEXT I
40 GOTO 10
```

Star Trek

on BBC Micro

It is a little known fact that the scripts of *Star Trek* were produced by Paramount's enormous 1960s valve operated computer. I have replicated the program for the BBC Micro. Indeed, it has proved possible to improve upon the original, producing scripts of a higher calibre than those filmed.

Of course, the program produces scripts of variable length. Paramount handled this by inserting fights and noble profile shots to pad out the episodes.

The program will run on either the Model A or B. Make sure that the strings in lines 130 and 505 are identical or the program will never end (that's how they got the motion picture).

Note that the only DATA strings requiring quotes are those containing commas. Also note the spaces which prevent words being split by line feeds.

Partial screen clear

on ZX81

by Calum Steen

After writing a program to help with tax returns, I found I needed a program to clear parts of the ZX81's display while leaving the lines showing the totals of each column intact.

The following machine code routine does this very quickly and needed only small changes to make it function as a very fast equivalent to the CLS command. This was considered necessary as the CLS command takes some time when the display and memory are full. It also leaves characters moving up and down the edge of the screen while it is working.

Rather than use the first REM statement and call the routines by USR 16514, which I find hinders the LOADING of some programs, he decided to make use of the NEXTLIN system variable. This is the BASIC loader program for the partial screen clear routine:

```
9900 LET A=(PEEK 16425+256*PEEK 16426)+5
9910 REM 1234567890123456789012345
9920 FOR N=A TO A+25
9930 INPUT B
9940 POKE N,B
9950 NEXT N
```

The program can then be RUN and the decimal codes entered one at a time followed by NEWLINE. This piece of code is 26 bytes long and works as explained in the right hand column, the decimal codes being in the left hand column each separated by a comma.

42,58,84 — LD HL,(16442): Register L is loaded with the line number for PRINT position.

69 — LD BL: This value is put into register B.

42,14,64 — LD HL,(16398): Register is loaded with

PROGRAM OF THE WEEK

address of PRINT position in D-FIELD.

126 — LD A,HL: Accumulator is loaded with value from

address specified through HL.

254,116 — CP 116: Accumulator decremented by 116.

32,8 — JPNZ 9: If result = 0 then jump forward 8 bytes.

5 — DEC B: Register B is decremented by one.

120 — LD A,B: Load accumulator with value in B.

254,8 — CP 8: Accumulator decremented by 8.

32,4 — JPNZ 4: If result = 0 then jump forward 4 bytes.

24,5 — JRS 5: Jump forward 5 bytes.

54,8 — LD HL,0: Memory location addressed through HL

is loaded with 0.

35 — INC HL: Register HL is incremented by 1.

24,236,JP,-18: Jump back 18 bytes.

201 — RET: Return to BASIC.

Lines 9900,9930,9940,9950 can now be deleted.

Line 9900 can be changed to LET RI=USR/PEEK

16425+...

Add 9915 RETURN

This routine can now be called by GOSUB 9900. Its effect will depend on the last PRINT statement executed. If it is like:

100 PRINT AT 16,5:"ZX81";

110 GOSUB 9900

then the screen will be cleared from line 10, column 10 to the bottom corner of the screen. If the statement is:

100 PRINT AT 16,5:"ZX81"

110 GOSUB 9900

then the screen will be cleared from line 11, column 0 to the bottom of the screen. The effect of this will only be seen if the screen was already full, of course. Using this property of the last semi-colon the desired type of display clearing can be obtained.

The second program was written to overcome the slowness of the CLS function. It is 24 bytes long and can be entered using a similar program to the one used previously.

9900 PRINT AT 0,0:

9905 LET A=(PEEK 16425+256*PEEK 16426)+5

9910 REM 123456789012345678901234

9920 FOR N=A TO A+23

9930 INPUT B

to next page

```
50 MODE7:FOR I=2703:VDU31,7,I,141,131:PRINT "S T A R T R E K":NEXT I:VDU31,12,5
1:PRINT "by Ian Bell"
90 BS=""
100 R=RND(11):IF R>7 X=500 ELSE IF R<4 X=520 ELSE X=500+200R
105 FOR D=0 TO 999:PRINT
110 PROC SAY(X):IF AS=D: GOTO 100
120 PRINT BS;" ";
130 IF AS<>"Take use out of orbit, Mr Spock" OR RND(4)<4 BS=AS:GOTO 100
140 PRINT "ALL! Hah! Hah! Hah!"" THE END"
150 END
300 DEF PROC SAY(X)
310 RESTORE X
320 READ M,A
330 FOR I=1 TO RND(A):ISLAD AS:NEXT
340 ENDPROC
500 DATA KINK: ",4,I'm responsible for the lives of 3000 crewmen,It's a thousa
nd to one against but it's our only chance
505 DATA "Take use out of orbit, Mr Spock","That's what makes us human, Mr S
pock."
520 DATA SPOCK: ",3,It appears to be some kind of unknown energy,Fascinating
,Most illogical
540 DATA SCOTTIE: ",2,"The enjins canna take it, Cap'n","She canna take the
strain, Cap'n"
560 DATA SULL: ",1,"Captain, it just ... disappeared"
580 DATA COTY: ",1,"He's dead, Jim"
```

Star Trek
by Ian Bell

Open Forum

from previous page

takes this space out so that the output looks neater. Lines 360 and 240 take care of the hex values A to F by converting them to decimal 10 to 15 and vice versa.

Sketch pad

on ZX81

This sketch pad program enables you to draw your own pictures and diagrams. To start simply type in line 10 as:

```
10 REM XXXX...360...XXXX
```

Then type:

```
20 FOR N=16514 TO 16550
30 INPUT A
40 POKE N,A
50 NEXT N
```

and then RUN.

Follow on by inputting these numbers in turn:

```
42, 12, 64, 35, 22, 1, 30, 1, 128, 6, 128,
203, 79, 40, 3, 144, 24, 1, 128, 119, 35, 20,
62, 33, 186, 32, 237, 35, 22, 1, 28, 62, 23,
187, 200, 24, 227.
```

After doing that delete lines 20 to 50 by typing in the rest of the program. SAVE all your work on to cassette before running. When RUN all will be made clear.

The inverse-video function enables you to edit your picture by changing to inverse and then filling in the white where the mistake was, then change back to normal video.

Maybe the National Gallery will accept some ZX masterpieces or have a special modern art display.

20000000 VIC-DECHEXDEC

Hex-decimal converter
by Ken Clark

```
100 REM VIC-DECHEXDEC 3.5K VIC KEN CLARK 1982
110 REM
120 REM CHANGES DECIMAL TO HEXDECIMAL & VICE VERSA.
130 REM FOLLOW HEX INPUT WITH THE LETTER "H"
140 REM WITH NO INTERVENING SPACES EG. FFH
150 REM INPUT DECIMAL WITH OUT EXTRA CHARACTERS
160 REM
170 INPUT#
180 IF RIGHT$(A$,1)="H" THEN L=LEN(A$)-1:GOTO320
190 IF ASC(A$)>C49 OR ASC(A$)>57 THEN420
200 REM** DEC TO HEX **
210 A=VAL(A$)
220 O=INT(A/16)
230 R=A-16*O
240 IF O>9 THENR$=CHR$(R+55):GOTO260
250 R$=RIGHT$(STR$(R),1)
260 S$=R$+S$
270 A=O:IFA=0 THEN290
280 GOTO220
290 PRINTA$;" DECIMAL=";"S$;" HEX"
300 GOTO430
310 REM** HEX TO DEC **
320 B$=LEFT$(A$,L)
330 FOR I=0 TO L-1
340 T$=MID$(A$,L,I)
350 IF ASC(T$)>32 THEN 420
360 IF ASC(T$)>64 THEN T$=ASC(T$)-55:GOTO380
370 T=VAL(T$)
380 W=T*16*I+W
390 L=L-1:NEXT I
400 PRINTB$;" HEX=";"H$;" DECIMAL"
410 GOTO430
420 PRINT"INPUT ERROR** TRY AGAIN"
430 W=0:S$="" :A$="" :GOTO170
```

```
10 REM ECRND7 3.5K 777=V554
GOSUB 7:BYE:GOTO5:STOP
15 DIM P$(100)
20 REM ARIAN JONES S/4/1982
30 PRINT TAB 10;"SKETCH PAD",T
40 PRINT "THIS PROGRAM IS A
POWERFUL AID FOR DRAWING PICTUR
ES ON TO THE SCREEN OR PAPER"
50 PRINT "THE SCREEN IS USED
AS A SKETCH PAD ON A 64 BY 42
GRID. 10,0 IS IN THE BOTTOM LEFT
60 PRINT "THE X CO-ORDINATE
IS THE NUMBER OF SPACES ALONG TH
E BOTTOM AND THE Y CO-ORDINATE
IS THE NUMBER UP THE SIDE."
70 PRINT "WHAT DO YOU WANT Y
OUR STARTING POSITION TO BE?"
80 PRINT "X=?";
90 INPUT X
100 IF X<64 AND X>=0 THEN GOTO
120
110 GOTO 90
120 PRINT X
130 PRINT "Y=?";
140 INPUT Y
150 IF Y<42 AND Y>=0 THEN GOTO
170
160 GOTO 140
170 PRINT Y
180 LET Y=Y+2
190 CLS
200 GOTO 9000
1000 LET A$=INKEY$
1010 IF A$="4" AND A$="9" THEN G
OTO 2000
1020 IF A$="I" THEN RAND USA 165
14
```

Sketch pad
by A. Jones

```
1000 IF A$="X" THEN GOTO 5000
1010 IF A$="Z" THEN COPY
1020 IF A$="L" THEN GOTO 3000
1030 IF A$="5" THEN GOTO 4000
1070 GOTO 1000
1080 REM PLOT NEW X,Y
1010 LET C=CODE A$-26
1020 LET X=X+(C*6):Y=Y+(C*6)
1030 LET Y=Y+(C*7):Y=Y+(C*5)-((C=
5)*Y*3)
1040 LET Y=Y+(C*7):Y=Y+(C*5)-((C=
5)*Y*3)
1050 PLOT X,Y
1060 GOTO 1000
1080 REM LINE ROUTINE
1010 PRINT AT 21,0;"POINT1. HOW
MANY SPACES ALONG?"
1020 INPUT A
1030 IF A=0 AND A<64 THEN GOTO
1050
1040 GOTO 3000
1050 PRINT AT 21,0;"POINT1. HOW
MANY SPACES UP?"
1060 INPUT B
1070 IF B=0 AND B<42 THEN GOTO
1090
1080 GOTO 3000
1090 LET B=B+2
1100 PRINT AT 21,0;"POINT2. HOW
MANY SPACES ALONG?"
1110 INPUT C
1120 IF C=0 AND C<64 THEN GOTO
1140
1130 GOTO 3110
1140 PRINT AT 21,0;"POINT2. HOW
MANY SPACES UP?"
```

Open Forum

Square roots

on Vic-20

Here are two suggestions for generating square roots on a Vic-20. Both first write the number T as $T = X \cdot 4 \uparrow N$ with N an integer and $25 \leq X < 1$.

The first method then approximates $\text{SQR}(X)$ by linear approximations using knowledge of square roots of $(5/10)^2$, $(6/10)^2$, $(7/10)^2$, $(8/10)^2$, $(9/10)^2$, and $(10/10)^2$. The second method approximates $\text{SQR}(X)$ by using a quadratic obtained by using the square roots of $(5/10)^2$, $(7/10)^2$ and $(10/10)^2$. Finally, the approximation is completed by a Newton method.

Fog

on ZX81

In this 5.75K program the idea is to get from one side of the gray fog to the other. However, there are a number of invisible objects which you must get past to reach the other side. You must also avoid a pursuing zombie and watch out for the mines. But do not take too long or you will run out of time.

When the game starts you will receive instructions. The screen will go black for a few seconds and then the fog and a time gauge will appear. You are represented by a ">" sign while the zombie appears as a "Z". If you find that you cannot move then you have hit a wall and will have to try a different direction.

REM statements show how the program is structured. Line 1 gives a 24 line screen. Putting all the instructions in one string enables them to be printed one character at a time.

Lines 2000 onward enable the game to start straight from loading. However, when SAVING you must type 'RUN 2000' instead of the normal 'SAVE'. My high score is 26, if you do better then change line 285.

```

3100 PRINT AT 01,0,"POINTS, NOW
3101 SPACES ALONG 0
3102 INPUT C
3103 IF C=0 AND C=64 THEN GOTO
3104
3105 GOTO 3130
3106 PRINT AT 01,0,"POINTS, NOW
3107 SPACES 0
3108 INPUT C
3109 PRINT AT 01,0,"
3110 IF C=0 AND C=64 THEN GOTO
3111
3112 GOTO 3140
3113 LET D=0
3114 LET E=0
3115 LET F=0
3116 IF ABS E THEN LET T=ABS E
3117 LET X=X+100/T
3118 LET Y=Y+100/T
3119 LET Z=Z+1
3120 LET D=D+1
3121 LET E=E+1
3122 LET F=F+1
3123 LET G=G+1
3124 LET H=H+1
3125 LET I=I+1
3126 LET J=J+1
3127 LET K=K+1
3128 LET L=L+1
3129 LET M=M+1
3130 LET N=N+1
3131 LET O=O+1
3132 LET P=P+1
3133 LET Q=Q+1
3134 LET R=R+1
3135 LET S=S+1
3136 LET T=T+1
3137 LET U=U+1
3138 LET V=V+1
3139 LET W=W+1
3140 LET X=X+1
3141 LET Y=Y+1
3142 LET Z=Z+1
3143 LET D=D+1
3144 LET E=E+1
3145 LET F=F+1
3146 LET G=G+1
3147 LET H=H+1
3148 LET I=I+1
3149 LET J=J+1
3150 LET K=K+1
3151 LET L=L+1
3152 LET M=M+1
3153 LET N=N+1
3154 LET O=O+1
3155 LET P=P+1
3156 LET Q=Q+1
3157 LET R=R+1
3158 LET S=S+1
3159 LET T=T+1
3160 LET U=U+1
3161 LET V=V+1
3162 LET W=W+1
3163 LET X=X+1
3164 LET Y=Y+1
3165 LET Z=Z+1
3166 LET D=D+1
3167 LET E=E+1
3168 LET F=F+1
3169 LET G=G+1
3170 LET H=H+1
3171 LET I=I+1
3172 LET J=J+1
3173 LET K=K+1
3174 LET L=L+1
3175 LET M=M+1
3176 LET N=N+1
3177 LET O=O+1
3178 LET P=P+1
3179 LET Q=Q+1
3180 LET R=R+1
3181 LET S=S+1
3182 LET T=T+1
3183 LET U=U+1
3184 LET V=V+1
3185 LET W=W+1
3186 LET X=X+1
3187 LET Y=Y+1
3188 LET Z=Z+1
3189 LET D=D+1
3190 LET E=E+1
3191 LET F=F+1
3192 LET G=G+1
3193 LET H=H+1
3194 LET I=I+1
3195 LET J=J+1
3196 LET K=K+1
3197 LET L=L+1
3198 LET M=M+1
3199 LET N=N+1
3200 LET O=O+1
3201 LET P=P+1
3202 LET Q=Q+1
3203 LET R=R+1
3204 LET S=S+1
3205 LET T=T+1
3206 LET U=U+1
3207 LET V=V+1
3208 LET W=W+1
3209 LET X=X+1
3210 LET Y=Y+1
3211 LET Z=Z+1
3212 LET D=D+1
3213 LET E=E+1
3214 LET F=F+1
3215 LET G=G+1
3216 LET H=H+1
3217 LET I=I+1
3218 LET J=J+1
3219 LET K=K+1
3220 LET L=L+1
3221 LET M=M+1
3222 LET N=N+1
3223 LET O=O+1
3224 LET P=P+1
3225 LET Q=Q+1
3226 LET R=R+1
3227 LET S=S+1
3228 LET T=T+1
3229 LET U=U+1
3230 LET V=V+1
3231 LET W=W+1
3232 LET X=X+1
3233 LET Y=Y+1
3234 LET Z=Z+1
3235 LET D=D+1
3236 LET E=E+1
3237 LET F=F+1
3238 LET G=G+1
3239 LET H=H+1
3240 LET I=I+1
3241 LET J=J+1
3242 LET K=K+1
3243 LET L=L+1
3244 LET M=M+1
3245 LET N=N+1
3246 LET O=O+1
3247 LET P=P+1
3248 LET Q=Q+1
3249 LET R=R+1
3250 LET S=S+1
3251 LET T=T+1
3252 LET U=U+1
3253 LET V=V+1
3254 LET W=W+1
3255 LET X=X+1
3256 LET Y=Y+1
3257 LET Z=Z+1
3258 LET D=D+1
3259 LET E=E+1
3260 LET F=F+1
3261 LET G=G+1
3262 LET H=H+1
3263 LET I=I+1
3264 LET J=J+1
3265 LET K=K+1
3266 LET L=L+1
3267 LET M=M+1
3268 LET N=N+1
3269 LET O=O+1
3270 LET P=P+1
3271 LET Q=Q+1
3272 LET R=R+1
3273 LET S=S+1
3274 LET T=T+1
3275 LET U=U+1
3276 LET V=V+1
3277 LET W=W+1
3278 LET X=X+1
3279 LET Y=Y+1
3280 LET Z=Z+1
3281 LET D=D+1
3282 LET E=E+1
3283 LET F=F+1
3284 LET G=G+1
3285 LET H=H+1
3286 LET I=I+1
3287 LET J=J+1
3288 LET K=K+1
3289 LET L=L+1
3290 LET M=M+1
3291 LET N=N+1
3292 LET O=O+1
3293 LET P=P+1
3294 LET Q=Q+1
3295 LET R=R+1
3296 LET S=S+1
3297 LET T=T+1
3298 LET U=U+1
3299 LET V=V+1
3300 LET W=W+1
3301 LET X=X+1
3302 LET Y=Y+1
3303 LET Z=Z+1
3304 LET D=D+1
3305 LET E=E+1
3306 LET F=F+1
3307 LET G=G+1
3308 LET H=H+1
3309 LET I=I+1
3310 LET J=J+1
3311 LET K=K+1
3312 LET L=L+1
3313 LET M=M+1
3314 LET N=N+1
3315 LET O=O+1
3316 LET P=P+1
3317 LET Q=Q+1
3318 LET R=R+1
3319 LET S=S+1
3320 LET T=T+1
3321 LET U=U+1
3322 LET V=V+1
3323 LET W=W+1
3324 LET X=X+1
3325 LET Y=Y+1
3326 LET Z=Z+1
3327 LET D=D+1
3328 LET E=E+1
3329 LET F=F+1
3330 LET G=G+1
3331 LET H=H+1
3332 LET I=I+1
3333 LET J=J+1
3334 LET K=K+1
3335 LET L=L+1
3336 LET M=M+1
3337 LET N=N+1
3338 LET O=O+1
3339 LET P=P+1
3340 LET Q=Q+1
3341 LET R=R+1
3342 LET S=S+1
3343 LET T=T+1
3344 LET U=U+1
3345 LET V=V+1
3346 LET W=W+1
3347 LET X=X+1
3348 LET Y=Y+1
3349 LET Z=Z+1
3350 LET D=D+1
3351 LET E=E+1
3352 LET F=F+1
3353 LET G=G+1
3354 LET H=H+1
3355 LET I=I+1
3356 LET J=J+1
3357 LET K=K+1
3358 LET L=L+1
3359 LET M=M+1
3360 LET N=N+1
3361 LET O=O+1
3362 LET P=P+1
3363 LET Q=Q+1
3364 LET R=R+1
3365 LET S=S+1
3366 LET T=T+1
3367 LET U=U+1
3368 LET V=V+1
3369 LET W=W+1
3370 LET X=X+1
3371 LET Y=Y+1
3372 LET Z=Z+1
3373 LET D=D+1
3374 LET E=E+1
3375 LET F=F+1
3376 LET G=G+1
3377 LET H=H+1
3378 LET I=I+1
3379 LET J=J+1
3380 LET K=K+1
3381 LET L=L+1
3382 LET M=M+1
3383 LET N=N+1
3384 LET O=O+1
3385 LET P=P+1
3386 LET Q=Q+1
3387 LET R=R+1
3388 LET S=S+1
3389 LET T=T+1
3390 LET U=U+1
3391 LET V=V+1
3392 LET W=W+1
3393 LET X=X+1
3394 LET Y=Y+1
3395 LET Z=Z+1
3396 LET D=D+1
3397 LET E=E+1
3398 LET F=F+1
3399 LET G=G+1
3400 LET H=H+1
3401 LET I=I+1
3402 LET J=J+1
3403 LET K=K+1
3404 LET L=L+1
3405 LET M=M+1
3406 LET N=N+1
3407 LET O=O+1
3408 LET P=P+1
3409 LET Q=Q+1
3410 LET R=R+1
3411 LET S=S+1
3412 LET T=T+1
3413 LET U=U+1
3414 LET V=V+1
3415 LET W=W+1
3416 LET X=X+1
3417 LET Y=Y+1
3418 LET Z=Z+1
3419 LET D=D+1
3420 LET E=E+1
3421 LET F=F+1
3422 LET G=G+1
3423 LET H=H+1
3424 LET I=I+1
3425 LET J=J+1
3426 LET K=K+1
3427 LET L=L+1
3428 LET M=M+1
3429 LET N=N+1
3430 LET O=O+1
3431 LET P=P+1
3432 LET Q=Q+1
3433 LET R=R+1
3434 LET S=S+1
3435 LET T=T+1
3436 LET U=U+1
3437 LET V=V+1
3438 LET W=W+1
3439 LET X=X+1
3440 LET Y=Y+1
3441 LET Z=Z+1
3442 LET D=D+1
3443 LET E=E+1
3444 LET F=F+1
3445 LET G=G+1
3446 LET H=H+1
3447 LET I=I+1
3448 LET J=J+1
3449 LET K=K+1
3450 LET L=L+1
3451 LET M=M+1
3452 LET N=N+1
3453 LET O=O+1
3454 LET P=P+1
3455 LET Q=Q+1
3456 LET R=R+1
3457 LET S=S+1
3458 LET T=T+1
3459 LET U=U+1
3460 LET V=V+1
3461 LET W=W+1
3462 LET X=X+1
3463 LET Y=Y+1
3464 LET Z=Z+1
3465 LET D=D+1
3466 LET E=E+1
3467 LET F=F+1
3468 LET G=G+1
3469 LET H=H+1
3470 LET I=I+1
3471 LET J=J+1
3472 LET K=K+1
3473 LET L=L+1
3474 LET M=M+1
3475 LET N=N+1
3476 LET O=O+1
3477 LET P=P+1
3478 LET Q=Q+1
3479 LET R=R+1
3480 LET S=S+1
3481 LET T=T+1
3482 LET U=U+1
3483 LET V=V+1
3484 LET W=W+1
3485 LET X=X+1
3486 LET Y=Y+1
3487 LET Z=Z+1
3488 LET D=D+1
3489 LET E=E+1
3490 LET F=F+1
3491 LET G=G+1
3492 LET H=H+1
3493 LET I=I+1
3494 LET J=J+1
3495 LET K=K+1
3496 LET L=L+1
3497 LET M=M+1
3498 LET N=N+1
3499 LET O=O+1
3500 LET P=P+1
3501 LET Q=Q+1
3502 LET R=R+1
3503 LET S=S+1
3504 LET T=T+1
3505 LET U=U+1
3506 LET V=V+1
3507 LET W=W+1
3508 LET X=X+1
3509 LET Y=Y+1
3510 LET Z=Z+1
3511 LET D=D+1
3512 LET E=E+1
3513 LET F=F+1
3514 LET G=G+1
3515 LET H=H+1
3516 LET I=I+1
3517 LET J=J+1
3518 LET K=K+1
3519 LET L=L+1
3520 LET M=M+1
3521 LET N=N+1
3522 LET O=O+1
3523 LET P=P+1
3524 LET Q=Q+1
3525 LET R=R+1
3526 LET S=S+1
3527 LET T=T+1
3528 LET U=U+1
3529 LET V=V+1
3530 LET W=W+1
3531 LET X=X+1
3532 LET Y=Y+1
3533 LET Z=Z+1
3534 LET D=D+1
3535 LET E=E+1
3536 LET F=F+1
3537 LET G=G+1
3538 LET H=H+1
3539 LET I=I+1
3540 LET J=J+1
3541 LET K=K+1
3542 LET L=L+1
3543 LET M=M+1
3544 LET N=N+1
3545 LET O=O+1
3546 LET P=P+1
3547 LET Q=Q+1
3548 LET R=R+1
3549 LET S=S+1
3550 LET T=T+1
3551 LET U=U+1
3552 LET V=V+1
3553 LET W=W+1
3554 LET X=X+1
3555 LET Y=Y+1
3556 LET Z=Z+1
3557 LET D=D+1
3558 LET E=E+1
3559 LET F=F+1
3560 LET G=G+1
3561 LET H=H+1
3562 LET I=I+1
3563 LET J=J+1
3564 LET K=K+1
3565 LET L=L+1
3566 LET M=M+1
3567 LET N=N+1
3568 LET O=O+1
3569 LET P=P+1
3570 LET Q=Q+1
3571 LET R=R+1
3572 LET S=S+1
3573 LET T=T+1
3574 LET U=U+1
3575 LET V=V+1
3576 LET W=W+1
3577 LET X=X+1
3578 LET Y=Y+1
3579 LET Z=Z+1
3580 LET D=D+1
3581 LET E=E+1
3582 LET F=F+1
3583 LET G=G+1
3584 LET H=H+1
3585 LET I=I+1
3586 LET J=J+1
3587 LET K=K+1
3588 LET L=L+1
3589 LET M=M+1
3590 LET N=N+1
3591 LET O=O+1
3592 LET P=P+1
3593 LET Q=Q+1
3594 LET R=R+1
3595 LET S=S+1
3596 LET T=T+1
3597 LET U=U+1
3598 LET V=V+1
3599 LET W=W+1
3600 LET X=X+1
3601 LET Y=Y+1
3602 LET Z=Z+1
3603 LET D=D+1
3604 LET E=E+1
3605 LET F=F+1
3606 LET G=G+1
3607 LET H=H+1
3608 LET I=I+1
3609 LET J=J+1
3610 LET K=K+1
3611 LET L=L+1
3612 LET M=M+1
3613 LET N=N+1
3614 LET O=O+1
3615 LET P=P+1
3616 LET Q=Q+1
3617 LET R=R+1
3618 LET S=S+1
3619 LET T=T+1
3620 LET U=U+1
3621 LET V=V+1
3622 LET W=W+1
3623 LET X=X+1
3624 LET Y=Y+1
3625 LET Z=Z+1
3626 LET D=D+1
3627 LET E=E+1
3628 LET F=F+1
3629 LET G=G+1
3630 LET H=H+1
3631 LET I=I+1
3632 LET J=J+1
3633 LET K=K+1
3634 LET L=L+1
3635 LET M=M+1
3636 LET N=N+1
3637 LET O=O+1
3638 LET P=P+1
3639 LET Q=Q+1
3640 LET R=R+1
3641 LET S=S+1
3642 LET T=T+1
3643 LET U=U+1
3644 LET V=V+1
3645 LET W=W+1
3646 LET X=X+1
3647 LET Y=Y+1
3648 LET Z=Z+1
3649 LET D=D+1
3650 LET E=E+1
3651 LET F=F+1
3652 LET G=G+1
3653 LET H=H+1
3654 LET I=I+1
3655 LET J=J+1
3656 LET K=K+1
3657 LET L=L+1
3658 LET M=M+1
3659 LET N=N+1
3660 LET O=O+1
3661 LET P=P+1
3662 LET Q=Q+1
3663 LET R=R+1
3664 LET S=S+1
3665 LET T=T+1
3666 LET U=U+1
3667 LET V=V+1
3668 LET W=W+1
3669 LET X=X+1
3670 LET Y=Y+1
3671 LET Z=Z+1
3672 LET D=D+1
3673 LET E=E+1
3674 LET F=F+1
3675 LET G=G+1
3676 LET H=H+1
3677 LET I=I+1
3678 LET J=J+1
3679 LET K=K+1
3680 LET L=L+1
3681 LET M=M+1
3682 LET N=N+1
3683 LET O=O+1
3684 LET P=P+1
3685 LET Q=Q+1
3686 LET R=R+1
3687 LET S=S+1
3688 LET T=T+1
3689 LET U=U+1
3690 LET V=V+1
3691 LET W=W+1
3692 LET X=X+1
3693 LET Y=Y+1
3694 LET Z=Z+1
3695 LET D=D+1
3696 LET E=E+1
3697 LET F=F+1
3698 LET G=G+1
3699 LET H=H+1
3700 LET I=I+1
3701 LET J=J+1
3702 LET K=K+1
3703 LET L=L+1
3704 LET M=M+1
3705 LET N=N+1
3706 LET O=O+1
3707 LET P=P+1
3708 LET Q=Q+1
3709 LET R=R+1
3710 LET S=S+1
3711 LET T=T+1
3712 LET U=U+1
3713 LET V=V+1
3714 LET W=W+1
3715 LET X=X+1
3716 LET Y=Y+1
3717 LET Z=Z+1
3718 LET D=D+1
3719 LET E=E+1
3720 LET F=F+1
3721 LET G=G+1
3722 LET H=H+1
3723 LET I=I+1
3724 LET J=J+1
3725 LET K=K+1
3726 LET L=L+1
3727 LET M=M+1
3728 LET N=N+1
3729 LET O=O+1
3730 LET P=P+1
3731 LET Q=Q+1
3732 LET R=R+1
3733 LET S=S+1
3734 LET T=T+1
3735 LET U=U+1
3736 LET V=V+1
3737 LET W=W+1
3738 LET X=X+1
3739 LET Y=Y+1
3740 LET Z=Z+1
3741 LET D=D+1
3742 LET E=E+1
3743 LET F=F+1
3744 LET G=G+1
3745 LET H=H+1
3746 LET I=I+1
3747 LET J=J+1
3748 LET K=K+1
3749 LET L=L+1
3750 LET M=M+1
3751 LET N=N+1
3752 LET O=O+1
3753 LET P=P+1
3754 LET Q=Q+1
3755 LET R=R+1
3756 LET S=S+1
3757 LET T=T+1
3758 LET U=U+1
3759 LET V=V+1
3760 LET W=W+1
3761 LET X=X+1
3762 LET Y=Y+1
3763 LET Z=Z+1
3764 LET D=D+1
3765 LET E=E+1
3766 LET F=F+1
3767 LET G=G+1
3768 LET H=H+1
3769 LET I=I+1
3770 LET J=J+1
3771 LET K=K+1
3772 LET L=L+1
3773 LET M=M+1
3774 LET N=N+1
3775 LET O=O+1
3776 LET P=P+1
3777 LET Q=Q+1
3778 LET R=R+1
3779 LET S=S+1
3780 LET T=T+1
3781 LET U=U+1
3782 LET V=V+1
3783 LET W=W+1
3784 LET X=X+1
3785 LET Y=Y+1
3786 LET Z=Z+1
3787 LET D=D+1
3788 LET E=E+1
3789 LET F=F+1
3790 LET G=G+1
3791 LET H=H+1
3792 LET I=I+1
3793 LET J=J+1
3794 LET K=K+1
3795 LET L=L+1
3796 LET M=M+1
3797 LET N=N+1
3798 LET O=O+1
3799 LET P=P+1
3800 LET Q=Q+1
3801 LET R=R+1
3802 LET S=S+1
3803 LET T=T+1
3804 LET U=U+1
3805 LET V=V+1
3806 LET W=W+1
3807 LET X=X+1
3808 LET Y=Y+1
3809 LET Z=Z+1
3810 LET D=D+1
3811 LET E=E+1
3812 LET F=F+1
3813 LET G=G+1
3814 LET H=H+1
3815 LET I=I+1
3816 LET J=J+1
3817 LET K=K+1
3818 LET L=L+1
3819 LET M=M+1
3820 LET N=N+1
3821 LET O=O+1
3822 LET P=P+1
3823 LET Q=Q+1
3824 LET R=R+1
3825 LET S=S+1
3826 LET T=T+1
3827 LET U=U+1
3828 LET V=V+1
3829 LET W=W+1
3830 LET X=X+1
3831 LET Y=Y+1
3832 LET Z=Z+1
3833 LET D=D+1
3834 LET E=E+1
3835 LET F=F+1
3836 LET G=G+1
3837 LET H=H+1
3838 LET I=I+1
3839 LET J=J+1
3840 LET K=K+1
3841 LET L=L+1
3842 LET M=M+1
3843 LET N=N+1
3844 LET O=O+1
3845 LET P=P+1
3846 LET Q=Q+1
3847 LET R=R+1
3848 LET S=S+1
3849 LET T=T+1
3850 LET U=U+1
3851 LET V=V+1
3852 LET W=W+1
3853 LET X=X+1
3854 LET Y=Y+1
3855 LET Z=Z+1
3856 LET D=D+1
3857 LET E=E+1
3858 LET F=F+1
3859 LET G=G+1
3860 LET H=H+1
3861 LET I=I+1
3862 LET J=J+1
3863 LET K=K+1
3864 LET L=L+1
3865 LET M=M+1
3866 LET N=N+1
3867 LET O=O+1
3868 LET P=P+1
3869 LET Q=Q+1
3870 LET R=R+1
3871 LET S=S+1
3872 LET T=T+1
3873 LET U=U+1
3874 LET V=V+1
3875 LET W=W+1
3876 LET X=X+1
3877 LET Y=Y+1
3878 LET Z=Z+1
3879 LET D=D+1
3880 LET E=E+1
3881 LET F=F+1
3882 LET G=G+1
3883 LET H=H+1
3884 LET I=I+1
3885 LET J=J+1
3886 LET K=K+1
3887 LET L=L+1
3888 LET M=M+1
3889 LET N=N+1
3890 LET O=O+1
3891 LET P=P+1
3892 LET Q=Q+1
3893 LET R=R+1
3894 LET S=S+1
3895 LET T=T+1
3896 LET U=U+1
3897 LET V=V+1
3898 LET W=W+1
3899 LET X=X+1
3900 LET Y=Y+1
3901 LET Z=Z+1
3902 LET D=D+1
3903 LET E=E+1
3904 LET F=F+1
3905 LET G=G+1
3906 LET H=H+1
3907 LET I=I+1
3908 LET J=J+1
3909 LET K=K+1
3910 LET L=L+1
3911 LET M=M+1
3912 LET N=N+1
3913 LET O=O+1
3914 LET P=P+1
3915 LET Q=Q+1
3916 LET R=R+1
3917 LET S=S+1
3918 LET T=T+1
3919 LET U=U+1
3920 LET V=V+1
3921 LET W=W+1
3922 LET X=X+1
3923 LET Y=Y+1
3924 LET Z=Z+1
3925 LET D=D+1
3926 LET E=E+1
3927 LET F=F+1
3928 LET G=G+1
3929 LET H=H+1
3930 LET I=I+1
3931 LET J=J+1
3932 LET K=K+1
3933 LET L=L+1
3934 LET M=M+1
3935 LET N=N+1
3936 LET O=O+1
3937 LET P=P+1
3938 LET Q=Q+1
3939 LET R=R+1
3940 LET S=S+1
3941 LET T=T+1
3942 LET U=U+1
3943 LET V=V+1
3944 LET W=W+1
3945 LET X=X+1
3946 LET Y=Y+1
3947 LET Z=Z+1
3948 LET D=D+1
3949 LET E=E+1
3950 LET F=F+1
3951 LET G=G+1
3952 LET H=H+1
3953 LET I=I+1
3954 LET J=J+1
3955 LET K=K+1
3956 LET L=L+1
3957 LET M=M+1
3958 LET N=N+1
3959 LET O=O+1
3960 LET P=P+1
3961 LET Q=Q+1
3962 LET R=R+1
3963 LET S=S+1
3964 LET T=T+1
3965 LET U=U+1
3966 LET V=V+1
3967 LET W=W+1
3968 LET X=X+1
3969 LET Y=Y+1
3970 LET Z=Z+1
3971 LET D=D+1
3972 LET E=E+1
3973 LET F=F+1
3974 LET G=G+1
3975 LET H=H+1
3976 LET I=I+1
3977 LET J=J+1
3978 LET K=K+1
3979 LET L=L+1
3980 LET M=M+1
3981 LET N=N+1
3982 LET O=O+1
3983 LET P=P+1
3984 LET Q=Q+1
3985 LET R=R+1
3986 LET S=S+1
3987 LET T=T+1
3988 LET U=U+1
3989 LET V=V+1
3990 LET W=W+1
3991 LET X=X+1
3992 LET Y=Y+1
3993 LET Z=Z+1
3994 LET D=D+1
3995 LET E=E+1
3996 LET F=F+1
3997 LET G=G+1
3998 LET H=H+1
3999 LET I=I+1
4000 LET J=J+1
4001 LET K=K+1
4002 LET L=L+1
4003 LET M=M+1
4004 LET N=N+1
4005 LET O=O+1
4006 LET P=P+1
4007 LET Q=Q+1
4008 LET R=R+1
4009 LET S=S+1
4010 LET T=T+1
4011 LET U=U+1
4012 LET V=V+1
4013 LET W=W+1
4014 LET X=X+1
4015 LET Y=Y+1
4016 LET Z=Z+1
4017 LET D=D+1
4018 LET E=E+1
4019 LET F=F+1
4020 LET G=G+1
4021 LET H=H+1
4022 LET I=I+1
4023 LET J=J+1
4024 LET K=K+1
4025 LET L=L+1
4026 LET M=M+1
4027 LET N=N+1
4028 LET O=O+1
4029 LET P=P+1
4030 LET Q=Q+1
4031 LET R=R+1
4032 LET S=S+1
4033 LET T=T+1
4034 LET U=U+1
4035 LET V=V+1
4036 LET W=W+1
4037 LET X=X+1
4038 LET Y=Y+1
4039 LET Z=Z+1
4040 LET D=D+1
4041 LET E=E+1
4042 LET F=F+1
4043 LET G=G+1
4044 LET H=H+1
4045 LET I=I+1
4046 LET J=J+1
4047 LET K=K+1
4048 LET L=L+1
4049 LET M=M+1
4050 LET N=N+1
4051 LET O=O+1
4052 LET P=P+1
4053 LET Q=Q+1
4054 LET R=R+1
4055 LET S=S+1
4056 LET T=T+1
4057 LET U=U+1
4058 LET V=V+1
4059 LET W=W+1
4060 LET X=X+1
4061 LET Y=Y+1
4062 LET Z=Z+1
4063 LET D=D+1
4064 LET E=E+1
4065 LET F=F+1
4066 LET G=G+1
4067 LET H=H+1
4068 LET I=I+1
4069 LET J=J+1
4070 LET K=K+1
4071 LET L=L+1
4072 LET M=M+1
4073 LET N=N+1
4074 LET O=O+1
4075 LET P=P+1
4076 LET Q=Q+1
4077 LET R=R+1
4078 LET S=S+1
4079 LET T=T+1
4080 LET U=U+1
4081 LET V=V+1
4082 LET W=W+1
4083 LET X=X+1
4084 LET Y=Y+1
4085 LET Z=Z+1
4086 LET D=D+1
4087 LET E=E+1
4088 LET F=F+1
4089 LET G=G+1
4090 LET H=H+1
4091 LET I=I+1
4092 LET J=J+1
4093 LET K=K+1
4094 LET L=L+1
4095 LET M=M+1
4096 LET N=N+1
4097 LET O=O+1
4098 LET P=P+1
4099 LET Q=Q+1
4100 LET R=R+1
4101 LET S=S+1
4102 LET T=T+1
4103 LET U=U+1
4104 LET V=V+1
4105 LET W=W+1
4106 LET X=X+1
4107 LET Y=Y+1
4108 LET Z=Z+1
4109 LET D=D+1
4110 LET E=E+1
4111 LET F=F+1
4112 LET G=G+1
4113 LET H=H+1
4114 LET I=I+1
4115 LET J=J+1
4116 LET K=K+1
4117 LET L=L+1
4118 LET M=M+1
4119 LET N=N+1
4120 LET O=O+1
4121 LET P=P+1
4122 LET Q=Q+1
4123 LET R=R+1
4124 LET S=S+1
4125 LET T=T+1
4126 LET U=U+1
4127 LET V=V+1
4128 LET W=W+1
4129 LET X=X+1
4130 LET Y=Y+1
4131 LET Z=Z+1
4132 LET D=D+1
4133 LET E=E+1
4134 LET F=F+1
4135 LET G=G+1
4136 LET H=H+1
4137 LET I=I+1
4138 LET J=J+1
4139 LET K=K+1
4140 LET L=L+1
4141 LET M=M+1
4142 LET N=N+1
4143 LET O=O+1
4144 LET P=P+1
4145 LET Q=Q+1
4146 LET R=R+1
4147 LET S=S+1
4148 LET T=T+1
4149 LET U=U+1
4150 LET V=V+1
4151 LET W=W+1
4152 LET X=X+1
4153 LET Y=Y+1
4154 LET Z=Z+1
4155 LET D=D+1
4156 LET E=E+1
4157 LET F=F+1
4158 LET G=G+1
4159 LET H=H+1
4160 LET I=I+1
4161 LET J=J+1
4162 LET K=K+1
4163 LET L=L+1
4164 LET M=M+1
4165 LET N=N+1
4166 LET O=O+1
4167 LET P=P+1
4168 LET Q=Q+1
4169 LET R=R+1
4170 LET S=S+1
4171 LET T=T+1
4172 LET U=U+1
4173 LET V=V+1
4174 LET W=W+1
4175 LET X=X+1
4176 LET Y=Y+1
4177 LET Z=Z+1
4178 LET D=D+1
4179 LET E=E+1
4180 LET F=F+1
4181 LET G=G+1
4182 LET H=H+1
4183 LET I=I+1
4184 LET J=J+1
4185 LET K=K+1
4186 LET L=L+1
4187 LET M=M+1
4188 LET N=N+1
4189 LET O=O+1
4190 LET P=P+1
4191 LET Q=Q+1
4192 LET R=R+1
4193 LET S=S+1
4194 LET T=T+1
4195 LET U=U+1
4196 LET V=V+1
4197 LET W=W+1
4198 LET X=X+1
4199 LET Y=Y+1
4200 LET Z=Z+1
4
```

Open Forum

```

220 LET Y=Y-(INKEY$="5")+INKEY
$="8"
225 IF H=47 THEN GOTO 400
230 IF Y>20 THEN GOTO 240
231 IF L=3 THEN GOTO 240
232 IF J=3 THEN LET J=J-1
233 IF J<X THEN LET J=J+1
234 IF K=Y THEN LET K=K-1
235 IF K=Y THEN LET K=K+1
236 LET Z=1
240 IF A(X,Y)=1 THEN GOTO 320
241 IF J=1 THEN LET J=2
242 IF J=20 THEN LET J=10
243 IF K=1 THEN LET K=2
244 IF K=20 THEN LET K=10
245 PRINT AT P,Q: " "
250 IF Z=1 THEN PRINT AT P,Q: " "
251 PRINT AT X,Y: "8"
252 PRINT AT J,K: "8"
255 IF J=K AND K=Y THEN GOTO 47
270 GOTO 170
271 REM *****
272 REM END OF GAME
273 REM *****
280 PRINT AT 21,1: "WELL DONE: YOU
U ESCAPED IN " + INT (100-B) / 60; "
MINUTES"
285 IF INT (100-B) / 60 > 2:25 THEN GOT
O 500
290 GOTO 350
300 PRINT AT 21,1: "UNLUCKY, OUT
OF TIME."
310 GOTO 350
320 LET X=P
330 LET Y=Q
340 GOTO 170
350 PRINT AT 22,10: "AGAIN?"
360 IF INKEY$="" THEN GOTO 350
361 LET A$=INKEY$
370 IF A$="Y" THEN GOTO 22
380 IF A$<"N" THEN GOTO 520
390 STOP
400 FOR I=1 TO 30
410 PRINT AT X,Y: "8"
420 PRINT AT X,Y: "8"
440 NEXT I
450 PRINT AT 21,1: "HIT NINE, YOU
LOSE"
460 GOTO 350

```

```

470 FOR I=1 TO 75
480 FAST
490 SLOW
495 NEXT I
500 PRINT AT 21,1: "ZOMBIE GOT Y
OU, YOU LOSE"
510 GOTO 350
520 PRINT AT 22,10: "EH"
530 FOR F=1 TO 50
540 NEXT F
550 GOTO 350
600 PRINT AT 22,1: "EXCELLENT TH
AT IS A BEST SCORE"
610 FOR A=1 TO 30
620 NEXT A
630 PRINT AT 22,1: "
640 GOTO 350
650 STOP
1000 REM *****
1001 REM INSTRUCTIONS
1002 REM *****
1005 LET A$="IN THIS GAME YOU AR
E IN A MAZE WHICH IS FULL OF FO
3.50 YOU CHANCE WHERE YOU ARE G
OING YOU HAVE TO GET OUT THE EXIT
IT IS ALONG ALL THE FAR SIDE, YOU MU
ST GET OUT BEFORE YOU RUN OUT
OF TIME, THERE IS A ZOMBIE WHO IS
OUT TO GET YOU, HE CAN BE SEEN
FLASHING, MOVES SLOWLY AND CA
N GO THROUGH WALLS, BEWARE OF TH
E FEW MINES
OUR MOVEMENT KEYS ARE: - 8....
... FORWARD 7....
... UP 6....
... DOWN 5....
... BACKWARDS"
1010 FOR I=1 TO LEN A$
1020 PRINT A$(I);
1030 NEXT I
1035 PRINT AT 20,6: "PRESS ANY KE
Y"
1040 IF INKEY$="" THEN GOTO 1040
1050 RETURN
1060 REM *****
1061 REM START GAME
1062 REM *****
1064 LET A$="MAZE"
1065 SAVE A$
1070 GOTO 1

```



**Available at
your
newsagent -
NOW**

POPULAR Computing WEEKLY

HOBHOUSE COURT, 19 WHITCOMB STREET WC2

Every week for 30p

Competitions

To tease and squeeze the best out of your rapidly developing computer brain.

Programming

To help you build your knowledge of sophisticated techniques. Step by step the secrets of the pros will be unfolded.

Clubs

What's happening inside Britain's mushrooming micro club world. Interviews and profiles of the new computing breed.

News

A really fast up-to-the-minute analysis of all that's going on

in the expanding world of micro technology.

Reviews

A panel of experts assess the latest products both soft and hard as and when they become available.

Programs

Readers' own programs published each week with prizes for the best entries.

Questions

Answered by an expert who knows... In short, it's a package you can't afford to be without. Make sure, place an order with your newsagent.



Programming

Knowing where the next byte is coming from

Stephen Devine explains how to squeeze programs into 1K by memory-saving techniques

ZX81 owners are often disappointed by the lack of memory on the basic machine. They often find themselves with programs which are just too long to fit within the available 1K. However, by using various memory saving techniques, it is often possible to sufficiently shorten these programs so that they can be run in 1K.

Since the method of storing floating point numbers on the ZX81 uses six bytes for each number, considerable savings in memory can be obtained by replacing all of the numbers in a program (except the line numbers) by equivalent symbols. If the numbers 0 and 1 are replaced by NOT PI and SGN PI respectively then four bytes are saved each time.

For larger single- or double-digit numbers the VAL function can be used. For example, VAL "4" saves two bytes since the digit 4 is stored as a string and not as a floating point number.

There are more ways to find extra bytes than the addition of a RAM pack.

The CODE function can be used for even larger numbers, provided that there is a symbol in the character set which corresponds to the number to be replaced. For example, CODE "IF" will replace the number 250.

If the same number is used repeatedly throughout a program, then it may be worthwhile assigning that number to a variable at the start of the program and using the variable each time the number is required. If the number 500 appears repeatedly in a program then it could first be assigned to a variable by, say, LET N = 500. Then statements such as LET X = X + 500 could be replaced by LET X = X + N saving five bytes each time.

Replacing all the literal numbers in a program will often save enough memory to enable the program to be run successfully but, if not, there are some further techniques which can be applied.

One method of saving memory is to reduce the memory requirements of conditional statements. For example, a statement of the form: IF A = X THEN LET P = P + 1 can be replaced by LET P = P + (A=X)

with a saving of six bytes. Much used statements in arcade type games are those using the INKEY function such as:

```
10 IF INKEYS = "I" THEN LET X = X + 1
20 IF INKEYS = "S" THEN LET X = X - 1
```

which might be used to move an object

back and forth across the screen. These can be replaced by the single statement:

```
10 LET X = X + (INKEYS="I") - (INKEYS="S")
```

saving 20 bytes each time. If the variable is to be incremented or decremented by more than one then the parentheses can be multiplied by the required number, for example:

```
10 IF INKEYS = "I" THEN LET Y = Y + 2
20 IF INKEYS = "S" THEN LET Y = Y - 2
```

can be replaced by:

```
10 LET Y = Y + VAL "2" *
   (INKEYS = "I") - (INKEYS = "S")
```

saving thirteen bytes.

Many PRINT statements can also be modified to consume less memory. For example, when printing instructions many words can often be replaced by single byte keywords.

Single stroke keywords

Take the statement PRINT "ENTER YOUR NAME". This can be replaced by the equivalent PRINT "INPUT YOUR NAME" where INPUT is entered as a single-stroke keyword. This saves six bytes, since the spaces before and after the word INPUT are free. Many more keywords such as IF, OR, TO, AND, THEN and others can also be used in this way. However, to enable certain words to be entered, it may be necessary to first enter THEN and edit it out afterwards.

When a text of concurrent lines is to be printed, such as:

It should also be remembered that GOTO's and GOSUB's need not be assigned a literal numerical value, such as GOTO 100, but can be used with functions. For example the routine:

By using some, or all, of the techniques outlined above and by experimenting with others you should find that there are few short programs which cannot be squeezed into 1K. Even some larger ones, which would normally use up to 2K of memory, can be effectively halved and run in 1K.

If a 16K RAM pack is added to the basic machine, the conservative use of memory should not be neglected. It makes for very efficient programming and, even with 16K of memory, there will still be some programs which are just that little bit too long.



Spectrum

In this new slot various contributors explore different aspects of the ZX Spectrum.

Making these graphics is easy as pie!

Nick Hampshire explains how to put different shapes into your circles

Line 10 Location of centre of disc on screen.
Line 20 Radius of disc.
Line 30 Increment of radius between circles.

The simple way to draw a disc is to use the CIRCLE command in a program loop. This varies the radius from the centre of the disc to the outside perimeter, thereby drawing a set of concentric circles. The distance between each concentric circle can be varied by changing the step value in the radius increment loop.

This method will accurately draw a high resolution disc on the screen, but it has two drawbacks: (a) the spacing between the dots in each concentric circle cannot be varied, and (b) it is impossible to draw a segment of a disc.

These drawbacks are overcome by the following program:



40 disc centre co-ordinates.
50 radius.
60 spacing between circles.
65 spacing between dots in a circle.

In this program lines 70 to 100 draw a circle on the screen at centre co-ordinates x_0, y_0 , of a radius ra and with a spacing between the dots of dp degrees. It should be noted that line 70 converts the degree angle dp increment into radians.

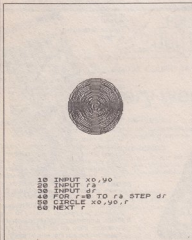
55 beginning angle of segment.
56 end angle of segment.

A variation of the previous program can be used to draw this segment of a disc. This requires two new parameters—the beginning angle of the segment and the end angle.

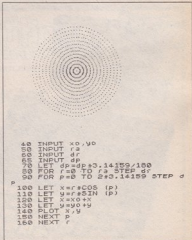


By using a combination of different segments, each with different dot densities, you can draw pie charts—a useful way of graphically representing data. The following program draws such a chart:

10 set centre to screen co-ordinates $x_0=100, y_0=100$.
12 set radius of full disc to 40.
14-50 the data used for each segment. This is in the following form — $p1$ =start angle, $p2$ =end angle (these determine the segment or wedge size), $D2$ and dp determine the dot spacing and therefore the density of the wedge.
70-100 the sub-routines to draw a disc segment.



```
10 INPUT x0,y0
20 INPUT ra
30 INPUT dr
40 FOR r=0 TO ra STEP dr
50 CIRCLE x0,y0,r
60 NEXT r
```



```
40 INPUT x0,y0
50 INPUT ra
60 INPUT dr
65 INPUT dp
70 LET dp=dp*0.14159/180
80 FOR r=0 TO ra STEP dr
90 FOR p=0 TO 2*0.14159 STEP dp
100 LET x=r*COS(p)
110 LET y=r*SIN(p)
120 LET x=x0+x
130 LET y=y0+y
140 PLOT x,y
150 NEXT p
160 NEXT r
```

Hand & mouth



Down to the bare essentials

A friend of mine recently received a clever little badge proclaiming "RPN OK RULES". Now, we all know that RPN—or Reverse Polish Notation—stands for the system of calculation in Hewlett Packard calculators and that everybody argues as to whether it is far better or far worse than the "Algebraic Logic" systems of other machines. Have you ever wondered about the derivation of this odd term?

Well, the connection with Poland comes from a man by the name of Jan Łukasiewicz, who was born in the Polish city of Łwów in 1878. He was a logician and mathematician, as well as an admired and articulate teacher, who eventually died in exile in Dublin in 1956. He arrived, at an early stage, at the conception of calculat-



ing the truth value of a logical statement—True, False or Don't Know—which is now seen in the Boolean Logic tables familiar to computing buffs.

His attempts to strip things down to only the bare essentials were highlighted in his "Polish Notation". This notation simplifies the evaluation of arithmetic expressions by eliminating parentheses and all punctuation.

Hewlett Packard have modified this by

specifying the operation to be performed after the entry of variables, as opposed to before as on the "Polish" system. Hence "Reverse Polish Notation".

Łukasiewicz was no mean writer, too, so I'll leave the last words to him: "Just as art grew out of the craving for beauty, science was created by the urge for knowledge. The saying 'art for art's sake' and 'science for science's sake' are equally valid."

John Gowie



Make macro moves on your micro

If you are writing a long program in assembly language you will find inevitably that some sections of the program are repeated more than once.

A macro assembler is simply a program with all the assembler features I have described in previous articles and the additional facility of assigning a name to a group of commands. For example, you could write a "macro" to set two zero page locations to a particular address:

```
MACRO1 LDA $000
      STA REFERENCE,X
      LDA $080
      STA REFERENCE,X
```

Whenever you want to use those instructions you simply insert the instruction

MACRO1 into your source code listing:

```
START LDH C1
      MACRO1
      LDH C3
      MACRO1
      LDH C9
      MACRO1
```

When you assemble the program the machine code instruction defined by the macro source code list will be inserted in the right place, with all the relative jumps worked out automatically.

A simpler version of the same idea is a facility to copy a block of source code lines from one place to another. In this case you will see all the instructions in the source code listing before it is assembled.

A macro assembler may seem much like using a call to a subroutine. This is not the case. A macro is an assembly time facility while a subroutine is an execution time function. Using a macro command to insert object code uses more memory than calling a subroutine but produces machine code that will run faster.

The Jump to SubRoutine (JSR) and ReTurn from SubRoutine (RTS) instructions each take 6 microseconds in a system using a 1MHz clock. If you have saved the CPU registers at the beginning of the SR and restored them at the end that will add a further 36 microseconds. By

contrast, a macro command uses as much RAM as the component instructions demand on each occasion, while a call to a subroutine only takes three bytes.

The time penalty imposed by subroutine calls can give you a measure of the efficiency of the program. Suppose you wrote a subroutine to double the contents of a zero page location:

```
1 PHF      Push CPU status
2 PHA      Push the accumulator
3 LDA WHEAT Load the accumulator with WHEAT
4 ASL A     Shift the accumulator left
5 STA WHEAT Store result in WHEAT
6 PLA      Pull the accumulator
7 PLP      Restore the CPU status
8 RTS
```

You can see that three instructions (lines 3-4-5) carry out the function of the SR and the others would not be present in a macro command.

The percentage inefficiency is calculated thus:

$$\% \text{ inefficiency} = \frac{\text{Total} - \text{Body}}{\text{Body}} \times 100$$

If you add up the microseconds for each instruction in the program above, you get the result:

$$\frac{28 - 8}{8} \times 100 = 250\% \text{ inefficient}$$

John Dawson

Sound & vision



Stringalonga maximum trickery!

The three routines listed will enable you to manipulate a string array containing a full screen image of 704 bytes. First of all, however, you need to put your string together. This can be done as follows. First, set RAMTOP with the following three commands:

```
POKE 16388,0
POKE 16389,125
NEW
```

Now LOAD any program which produces an interesting screen image. Then add the following subroutine to that program. I have numbered the subroutine to start at 9000, but you can use any convenient numbers.

```

9030 LET Q=1+PEEK 16396+256*PEEK 16397
9040 FOR I=0 TO 700
9050 POKE 32000+I*PEEK (Q+1+INT (.537))
9060 NEXT I
9070 RETURN

```

You will also need to add some method of calling that subroutine when a suitable image is displayed on the screen. RUN the program and, when you have a good image, call the subroutine. When it has run

its course, STOP the program and clear it by pressing NEW. Provided you do not turn off the power, the image will remain in store over RAMTOP.

The next step is to call this image into a literal string:

```
10 LET A$=""
20 FOR I=32000 TO 32700
30 LET A$=A$+CHR$(PEEK I)
40 NEXT I
50 PRINT A$
```

RUN this program and the image will be displayed. From now on, it is important not to use CLEAR or RUN, as these will lose AS. Press newline, and write the following program over the existing one (Note that the contents of XS must be the graphics characters represented on the keys in line 20):

[illegible]

```

180 NEXT J
110 NEXT I
120 CLS
130 PRINT ZS
140 STOP
150 FOR K=15 TO 28
160 IF X=CODE XS(K) THEN GOTO 180
170 NEXT K
180 LET X=CODE XS(K-14)
190 RETURN

```

To operate this program, use GOTO 1. The screen image will be printed as before, but with one important difference — it has been reversed left to right.

The key to the system is the string set up in line 20. This ensures that those charac-

ters which are asymmetrical (apart from letters and numbers) are reversed, to preserve the integrity of the image. Any words or numbers will be reproduced backwards.

A similar device is used in the next routine, which has the effect of turning the image through 180 degrees. This routine is exactly the same as About Turn, except for the following lines which should be altered. As with About Turn, the numbers and letters in the string in line 20 represent the graphics characters which are to be found on those keys. Again, do not RUN the program, but GOTO 1:

```

28 LET X$="123456789QWERTYSCFG34128765
   ERQWDSQF"
48 LET I = PEEK 16396+256*PEEK 16397-684
60 FOR I=I TO I-684 STEP -33
80 IF X=8 AND X<11 AND X<>6 AND X<>8 OR
   X<128 AND X<139 AND X<>134 AND
   X<>136 THEN GOSUB 150
150 FOR K=17 TO 32
180 LET X=CODE X$(K-16)

```

This routine produces a straightforward reversal top to bottom. It is the same as Tricky Turnover except for the following lines. The characters in the string in line 20 represent the graphics characters found on those keys:

```

Upside Downside
20 LET XS="123456789QWERTYASDFGH432176
   REWOYTHDSGFA"
60 FOR J=1 TO I-1
80 IF X>8 AND X<11 AND X<>5 AND X<>8 OR
   X<120 AND X<130 AND X<>133 AND
   X<>136 THEN DOSUB 150
150 FOR K=19 TO 35
160 LET X=CODE(XS(K)-18)

```

The same rules apply as for the other routines, ie: GOTO 1, not RUN* in all cases. The second image is transferred into Z\$, which is a literal string 704 bytes long (ie: LEN Z\$=704). Nick Godwin

Being backwards in coming forward

This week, two programs using the important pair of commands on the BBC Micro known as VDU5 and VDU4.

Briefly, VDU5 causes the text cursor to be positioned exactly (not just to the nearest print position) in the same place as the graphics cursor. So you can plot text, even in colour, anywhere on the screen.

VDU5 switches this effect on, VDU4 switches it off again.

The following programs both generate lissajous curves on the screen. But they use words, not lines.

Two psychologically unsettling effects are used: one where the names of colours are written in another coloured text, the other using the words FORWARD and BACK to flash back and forth on the

[illegible][illegible]

screen, not always doing what they say.

Finally, note that VDU19,N,C,0,0,0 is used to change colour number N to actual colour number C — for instance, you can

make colour 1 (normally red) become blue. The three zeroes are there for other purposes, and should always be left like that.

Brian Reffin Smith

Brian Riffin Smith

Peek & poke

Peek your problems to our address. Ian Beardsmore will poke back an answer.

DON'T GIVE UP ON DEAR OLD UNTY

R. Bass of Beech Road, Northwich, Cheshire, writes:

Q I recently received a BBC microcomputer. After trying the test Mr Reffin Smith gave in his article in your April 23 issue, I found that I have a BBC micro with the older operating system. Mr Smith said, "... doubtless all will be put right", but what do owners of such machines need to do?

Also the "FX function is inadequately defined, and apparently is not going to be put in the guide. Where can I find out about its uses? Even Peek & poke just give "bad command".

Lastly, when can we expect the impatiently-awaited full guide.

A BBC micro owners need to resist the temptation to give up in despair. The full guide should cover all the points you raise in more detail than I can here.

A lot of pressure has been put on the BBC, and it now seems likely that the full guide will be ready for dispatch on June 10. I am afraid that I cannot offer you much more until the guide arrives.

JUST MAKE A NEW GEAR RESOLUTION

A. D. Hoadley of Haslet Avenue, Crawley, Sussex, writes:

Q In your review of the ZX Spectrum in the May 6 edition you said "... screen resolution of 32×24 is adequate ... although this can be enlarged under software control to normal teletext standard."

Please could you explain what this means. What software? When is it available? Does it mean that adequate resolution is made sharper by this process?

A Teletext standard is 40 characters per line as opposed to the 32 which the spectrum will use normally. As for the software mentioned no

one is as yet quite sure what is meant by that.

There is an architecture within the ROM for maintaining a teletext compatible 40×24 screen display. But, strictly speaking, that is firmware. The teletext adaptor is, of course, hardware.

So far we can only hazard one of two guesses. Either the PR boys who have been telling everyone about this software have in fact confused their terms, or the teletext architecture will be accessed by an, as yet, unrevealed machine code routine. On reflection, I think that I marginally favour the first option.

As for making the resolution sharper, I doubt it. With the extra characters per line, you are trying to get more, not less, into the same space. Nevertheless, indications are that the screen resolution will still be sufficiently good enough for this not to cause any problems.

THERE'S LIFE IN THE OLD DOG YET

David Paine of Victoria Road, Pembroke Dock, Dyfed, writes:

Q As an avid fan of the ZX81 I am very interested in its long life on the computer market. But, after reading your review of the ZX Spectrum, I am not sure whether the ZX81 will still be made after the Spectrum becomes available. Please could you tell me what will happen to the ZX81?

A To date, approximately four hundred thousand ZX81s have been made. A few months ago Clive Sinclair signed a giant American company, Timex, to make ZX81s under licence. Conservative estimates maintain that, as a result of this deal, the ZX81 will become the world's first million selling computer by the end of the year.

In this country, even if half the ZX users decide to change, it will take quite a few months for the new machines to be dispatched. Many of the

ZX81s will probably be sold second hand to first-time users, who quite naturally will be interested in ZX81 material.

So, while this country will probably be the first to see the phasing out of the ZX81, there are just too many machines in use for this to be a quick process. I am sure that the ZX81 will enjoy considerable support for some time yet.

AND THE MEMORIES STILL LINGER ON

John Bender of Felton Close, Orpington, Kent, writes:

Q I have a ZX81 with a 16K RAM pack and have written quite a long program. I know it is too long for the standard 1K machine, but how can I find out how much actual memory it has taken?

A The program file starts at the address 16509. The last address of the program file is called D-FILE, which is located at addresses 16396 and 16397. The difference between 16509 and the address in D-FILE is the number of bytes in a program. If you enter as a direct command:
PRINT PEEK 16396+256* PEEK 16397-16509

you will get the amount of bytes in your program. If you enter:

PRINT PEEK 16494+256* PEEK 16495-16384

you will get the number of bytes occupied by the program, all the variables and the screen. The following commands:

PRINT PEEK 16386- PEEK

16412+256*

(PEEK 16387-PEEK 16413)-50

will give you an idea of how many bytes you have left in which to work at a particular time.

IT'S ALL A QUESTION OF COMPATIBILITY

Alasdair Crawford of Murray Drive, Stonehouse, Scotland, writes:

Q I have a BBC micro-computer model A. Having read your review of the ZX Spectrum, I am still convinced that the BBC is the

best machine yet available. But I am very interested in the £50 ZX Microdrive. Can you please tell me if it would be possible to connect the Microdrive to the BBC Micro-computer?

A There is a general feeling that if the ZX Microdrive meets the quoted specifications, then it will be of far greater importance to the world of computing than the Spectrum. After all, it does seem to be something of a storage revolution.

It must, however, be borne in mind that the Microdrive has only been seen once in public, and that very briefly at the launching of the ZX Spectrum. To my knowledge, no one has had so much as a close look at it, yet let alone a chance to do a thorough benchmark to analyse its full potential.

While it is due to be launched about August, Sinclair Research and launch dates do not always coincide. So, I do not think it will be readily available until the autumn at least.

Given that the ZX printer can now be interfaced with other computers, I am sure that the Microdrive will also breed a host of compatible interfaces. Even if an interface costs £100, which I doubt, I am sure that it would sell.

A quick comparison with the New Vic disc drive will illustrate just how important this microdrive could be. With an interface costing £100, you would still get more storage with a Microdrive for almost £200 less than the Vic disc drive.

If the microdrive is not buggy, and that must still be quite a big if, then a race will be on to make it compatible with other computers. But this is several months in the future. Perhaps an early letter to Father Christmas might not come amiss.

Send your questions to Peek & poke, Popular Computing Weekly, Hobhouse Court, 19 Whitcomb Street, London WC2 7HF.

Competitions

Puzzle No 10

Young David was playing with his pocket calculator the other day, when he discovered that if he multiplied 21 by 82 the answer, 1827, consisted of the same four digits, though differently arranged.

This set him thinking of how many other similar examples were possible, each having this property.

How many other sets of numbers are there?

Remember that each set must consist of two two-digit numbers which, when multiplied together produce a four-digit number formed from the same numbers. In each case, all four digits should be different.

Solution to Puzzle No 6

The simplest way of solving this problem is to generate the values for I N C H in sequence, using four FOR/NEXT loops. The process is simplified if we realise that the value of I N C H must be greater than the square root of 10000000 (the smallest product with at least eight digits). We can therefore commence the 'I' loop at the value 3. To put into the program extra lines to further define the minimum value of I N C H as 3162 would probably be more involved than letting the program run from the starting value of 3000. The only point to be borne in mind is that these first few seven-digit numbers could cause an error condition in line 90 if the subtring was defined as (5 TO 8). Consequently I have used the form (5 TO) which will permit both seven and eight digit numbers to be divided without error. Users of other forms of Basic will need to make their own adjustments.

H can only be equal to either 0, 1, 5, or 6 so lines 40 to 60 correct this.

10 FOR I = 3 TO 9

20 FOR N = 0 TO 9

30 FOR C = 0 TO 9
40 FOR H = 0 TO 9
50 IF H = 3 THEN LET H = 5
60 IF H = 7 THEN NEXT C
70 LET INCH = I * 1000 + N * 100 + C * 10 + H
80 LET P = 5 * STR\$(INCH * INCH)
90 IF VAL P\$(5 TO) = INCH THEN PRINT INCH
100 NEXT H
110 NEXT C
120 NEXT N
130 NEXT I

Answer: INCH = 9376

Winner of Puzzle No 6

The winner is: Ian Black, Great Wymondley, Hitchin, Herts, who receives £10.

Solution to Crossword No 6

Across: 8 Aha 9 Statement 10 Detritus 11 Loop 13 Memory 14 Length 17 Goto 18 Tangents 20 Dimension 21 Val.

Down: 1 Random 2 Waste my time 3 Ostary 4 Value 5 Len 6 Men of Geneva 7 Stop 12 Reagent 15 Hustle 16 Basic 17 Gods 19 Int.

Winner of Crossword No 6

The winner is: B. Turks, Chingford Hatch, London, who receives £10.

Rules

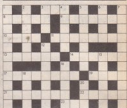
The winner of the puzzle will be the reader who, in the opinion of Popular Computing Weekly, has submitted the best solution. Preference will be shown to submissions which show how the entrant arrived at the correct answer, and to entries that indicate, in any way, how a micro might be applied.

The winner of the crossword will simply be the first name out of the hat.

The closing date for both the puzzle and the crossword is Monday, July 5.

Please mark your envelopes clearly with either CROSSWORD or PUZZLE.

Crossword No 10



ACROSS

- 3 Chip starts examination of freezing water (3)
- 6 Ribs a minced joint (5)
- 9 Spotted ship add-on (7)
- 10 Pleasant place to give directions to a ship (4)
- 11 A yule loan arrangement that's not tight (6)
- 13 Concealed one and tuppence in bowl (5)
- 14 Pain reliever has principle ingredient (5)
- 17 Furry tale for a dead empire and first true ship (8)
- 18 Return account for a weight (4)
- 21 Fugitive and left with permission (7)
- 22 Slopes that start regulating current (3)
- 23 Total chip removed from music and returned (3)

DOWN

- 1 Chips for Gallic cocks (7)
- 2 Gone off and managed detectives (5)
- 3 Anxious that of about (3)
- 4 Not odd — true happening (6)
- 5 Any wall confused: The investigator (7)
- 6 Open-mouthed, go up under a good leader (4)
- 7 Without a care for worthless, effortless combination (4, 3, 4)
- 8 Seven ways to find business (7)
- 10 Men are changed into new identity (8)
- 16 Turns and blows (5)
- 18 Chip in, the robot! (4)
- 20 Supply weapons for a member (3)

CITIZEN PAIN

BY DAVID IRELAND AND JAMES MACDONALD

HOW HAD CITIZEN PAIN ESCAPED THE HORRIBLE JOB CENTRIES ?...



HIS WAS PAID
10 GORDON'S
A WEEK

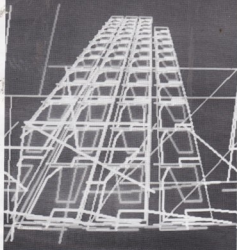
* NOT
VERY MUCH



commodore

COMPUTING

April/May 1982 £1.25



An exciting new Commodore peripheral

Own or use a Pet or a Vic?

Fed up with being ignored by all the traditional monthly magazines?

Fed up with listings, which are too simple or simply do not work?

You need *Commodore Computing*, the new monthly magazine. *Commodore Computing* is published by Nick Hampshire, author of *The Pet Revealed*, *Pet Graphics*, *A Library Subroutines* and *The Vic Revealed*.

Each issue is packed with advanced

advice on how to make the most of your computer, whether you use a Pet or a Vic.

Each issue covers a host of applications – software, hardware, machine code, games, business use – whatever it is you'll find it in *Commodore Computing*.

If you want to learn more about your computer, take out a subscription to *Commodore Computing*.

That's the only way to get it, and get it straight.

Send £12.50 for 1 year's subscription (10 issues) to:

Commodore Computing,

Magsub, Oakfield House, Perry Mount Road, Haywards Heath, Sussex RH16 3DH

Bancet.

ANGLO AMERICAN SOFTWARE CO.

SOFTWARE SPECIALISTS

| | | |
|---|--|------------------|
| Starfleet Orion | PET 8K TRS-80 Level II 16K TRS-80 32K w/disk APPLE Integer BASIC 16K APPLE Integer BASIC w/disk 48K | £19.50 |
| Invasion Orion | TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £19.50 |
| Temple of Apshai | TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk ATARI 32K ATARI 32K w/disk IBM 64K w/disk | £23.50 |
| Hellfire Warrior | TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk | £23.50 |
| Upper Reaches of Apshai | TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk | £15.50 |
| The Keys of Acheron | TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk | £15.50 |
| Curse of Ra | TRS-80 32K — APPLE 48K w/disk TRS-80 Level II 16K 24K PET w/disk TRS-80 32K APPLE 48K w/disk | £15.50 £32.00 |
| Introductory 3-Pack 3-Pack: Morloc's Tower, Rescue at Rigel and Datesones of Ryn | TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K 2/disk PET 24K TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk APPLE 32K | £15.50 |
| Datesones of Ryn | 32K PET APPLE 48K w/disk | £19.50 |
| Morloc's Tower | TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £21.50 |
| Dragon's Eye | TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £21.50 |
| Sorcerer of Siva | TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £23.50 |
| Rescue at Rigel | TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £21.50 |
| Star Warrior | TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £21.50 |
| Crush, Crumble and Chomp! | TRS-80 Level II 16K — ATARI 32K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £21.50 |
| Tuesday Morning Quarterback | TRS-80 48K — APPLE 48K w/disk ATARI 16K — TRS-80 Level II 16K TRS-80 32K — APPLE 48K w/disk ATARI 32K w/disk | £19.95 |
| Ricochet | TRS-80 32K — APPLE 48K w/disk IBM 64K w/disk | £21.50 |

SEND 75p FOR FULL CATALOGUE
(Refundable against purchase)
DEALER ENQUIRIES WELCOME

ANGLO AMERICAN SOFTWARE

138a Stratford Road, Sparkhill
Birmingham B11 1AG 021-771 2995/2736

ALL PRICES INCLUDE VAT & POSTAGE
24 Hour answering service
on 021-771 2995 for Access orders.



PLEASE SUPPLY _____

I enclose a cheque/PO for £_____ made payable to
ANGLO AMERICAN or debit my _____

Access and number _____

Signature _____

NAME _____

ADDRESS _____

